Charls Hunt


# SCIENTIFIC AMERICAN

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## IMPROVED REBOLTING MACHINE.

The invention herewith illustrated is a sawing apparatus, contrived for rebolting large bolts of timber without quite separating the smaller bolts from each other, so that they will hold together, admitting of handling or dogging in the shingling or other machine, in which they are to be finally cut up. By this means the machine may be supplied with timber to its full working capacity, while, at the same time, cutting the shingles or other pieces as narrow as desired.

In the perspective view, Fig. 1, A is the carriage which moves under the saw, B. The depth of the carriage under the blade is such that the latter does not reach the bottom, so that the bolt, secured in saw carriage, will not be cut entirely through. This will be understood from the sectional view, Fig. 2, in which the bolt is represented by dotted lines, D. C is a tilting rest for the bolt, upon which the sap side of the latter, generally bevel to the other sides, is placed, and held so that the saw kerf will pass down to the axis of the rest, thus leaving sufficient wood to hold the portions together, no matter how much the bottom may be inclined as regards the sides.

At E is a pair of clamps which work upon right and left hand screws, F, Fig. 2, and are operated by the crank, G, Fig. 1. These serve to hold the bolts securely while being cut. A portion of the carriage, H, is elevated, in order to accommodate pieces which are to be divided entirely, as in ordinary sawing machines. The track of the carriage is made in two portions, one above the other, so that the upper part can be vertically adjusted as may be required, for saws of different sizes, or as the blade wears away.

Patent pending through the Scientific American Patent Agency. For further particulars address W. A. Fletcher, Beaumont, Jefferson county, Texas.

## THE COMBINATION FOOT LATHE.

For the use of amateurs, and for mechanics who desire to economize both in the cost of, as well as in the space occupied by, their tools, the novel device herewith illustrated will be found of much utility. It is a simple foot lathe, with which are combined a jig and a circular saw.

The former, which is represented on the right of the machine, is actuated by a pitman which connects eccentrically with the end of a shaft, A, passing under the apparatus. Motion is communicated to this shaft by a separate belt from the main pulley. The pitman operates a pivoted lever which, by an adjustable connection, B, transmits its motion to the saw arm. The saw works through a suitable table, and is tightened by a set screw in the connection, B. We are informed that it penetrates timber an inch and a half in thickness with perfect readiness.

At the opposite end of the lathe, and attached to the main arbor, is a small circular saw. This has an adjustable table which is provided with the usual guides, etc. By turning back the table, and removing the saw, an emery or buffing wheel may be substituted in its place upon the arbor.

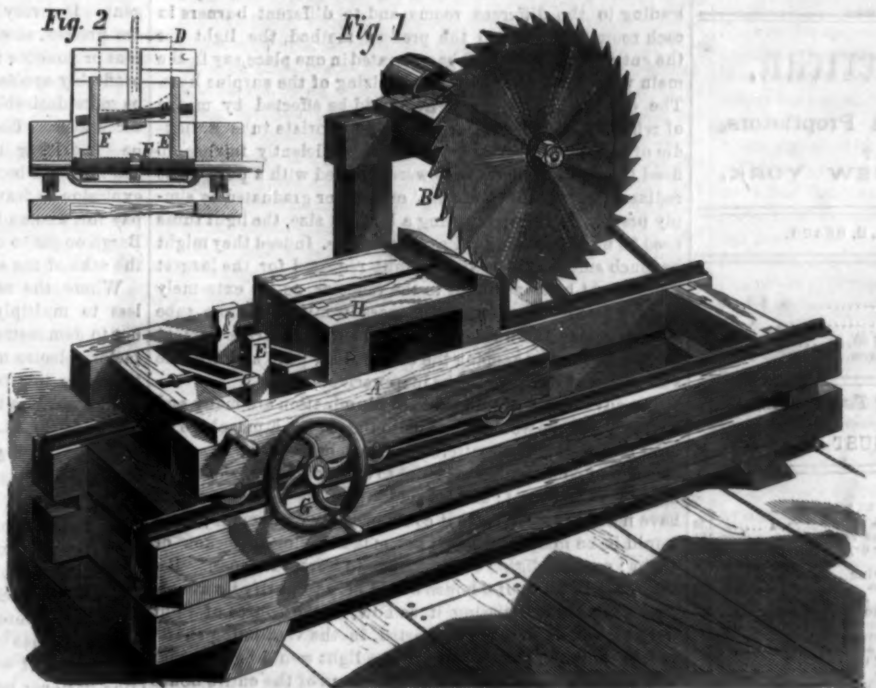
Regarding the lathe itself, other than to notice that it is neatly and substantially built, and appears to be an efficient and reliable tool, no particular description is needed.

The apparatus is manufactured by Strange's Cylinder Saw Machine Company, of Taunton, Mass. For further particulars address O. W. Leonard, sole agent, 40 John street, New York city. Patent now pending.

IRON HAIL.—Professor Eversman has had occasion to examine, at Kasan, hailstones containing crystalized iron pyrites. The cause of this rare phenomenon, no doubt, was that small crystals of pyrites, proceeding from the disintegration of a rock, had been transported by a tempest into the clouds, where they were iced and converted into hailstones.

## Rattan.

Rattan comes from the East Indies, principally from Singapore, Pedang, Penang, Samarang, and St. Simon's Bay. The United States consumes three quarters of the total product, the imports amounting now to something more than 6,000,000 pounds. The *Calamus Rotang* belongs to that peculiar species of palm which secretes in its cuticle a very considerable amount of silica, while its inside is made up of tough and fibrous filaments. The outside, with the smooth natural varnish, when stripped off by particular machinery, is used for seating chairs. The inside of the rattan is employed in a variety of ways. It is shaped by machinery either round or flat, and so worked up into innumerable articles. Baskets, brooms, mats, matting, are all made from the inside of the rattan, and an immense quantity of it is worked around demijohns. Split rattan is made up into some half dozen different sizes, and is then sold by the 1,000 feet. The finest qualities of rattan are used by whip makers. This large and constantly increasing business may be estimated by the fact that one factory in New England alone employs 1,000 operatives, and that the total number of people working in rattan (the schoolmasters excluded) is fully 1,800. The capital used in the manufacture of rattan is about $2,000,000.




FLETCHER'S REBOLTING MACHINE.

THE COMBINATION FOOT LATHE.

## A Great Flour Mill.

Glasgow has long been noted for the number and improved structural and mechanical arrangements of its flour mills, and Messrs. John Tod & Co. have just erected in the Govan road a new mill, which, so far as grinding power is concerned, is second to none in the great port of the Clyde. Altogether, apart from the care which has been exercised in the erection of the building so as to prevent the origin and spread of fire, the grinding machinery is of the most complete description. By means of telescopic pipes, for instance, passing down to every floor, it is possible, should the wheat get out of order at any time by overheating or otherwise, to shift it from one floor to the other. Another interesting arrangement is one by which the central portion of the store may be converted into a hopper from top to bottom, communication being easily made with all the elevators and screws in the store, which itself is so substantially constructed that it would be perfectly safe, although filled quite solid with grain. With regard to the cleaning machinery, the grain enters, by means of a hopper, into the wheat separator, in which the accidental grains of Indian corn and straw, and the greater portion of dirt accompanying the wheat, are removed from it. The scrubber is a machine of complicated construction, which next removes the feather end of the grain and a large portion of the bran. The wheat is then conveyed by a spout to an elevator, which takes it to the top story of the mill. Of the twenty-five pairs of millstones which it is intended to introduce, twelve are erected and in operation. The stones are each 4 feet 3 inches in diameter by 12 inches thick, and the cost is about $150. They are made of French buzr, an interesting and not very common form of silica, of a cellular texture, which, for industrial purposes, is almost entirely derived from the mineral basin of Paris and a few adjoining districts. Considerable care and skill are required in their preparation. The revolving stone usually makes about 120 revolutions per minute. Four movable balance weights are set in its upper surface, so fitted that by the motion of a screw the stone can be made to lie perfectly level when in motion, this being a most essential condition in good grinding. The opposite surfaces of the stones, from the peculiarity of their dressing, act upon the grain like the blades of a pair of scissors. The white meal, being carried to the uppermost floor, enters a cooler, which is a circular vessel, about 9 feet in diameter, and about 27 inches high, the sides being formed of galvanized sheet iron. There is a vertical spindle in the center, and at the bottom of this a horizontal arm provided with twelve wooden blades, so set that they spread the meal as evenly as possible, and gradually move it out to the circumference of the cooler. At one part of the latter, there is a hopper opening into a spout, by which the meal is conveyed to the floor below, where it is subjected to the first dressing process, the object of which is to separate the bran. The dressing machine may be described generally as a large wooden case, in which revolves horizontally a six-sided framework of wood, having a peculiar kind of silk fabric stretched over it. Inside the silk covered framework there are a number of wooden blades set obliquely, so as to carry the bran forward to the further end of the machine, the coarse dressed flour meanwhile passing through the silk into the screw elevator, which conveys it to another cooler in the floor above. There are four of these coolers, all in the fifth or upper floor of the mill. Messrs. Tod & Co. are also preparing to erect, in addition to the grinding stones, a number of steel rollers, similar to those used in the mills of Hungary for the production of that superior class of flour known in the trade as Hungarian whites. When the mill, as at present designed, is complete, the making power will not be less than 3,000 sacks per week. The steam power for these varied operations is generated in a pair of horizontal multitubular boilers, 12

feet long by 16 feet in diameter, working to a pressure of 70 lbs. per square inch, and supplied by Messrs. Lees, Anderson & Co., Clyde street, Anderston: the pair of fine engines by which the machinery is driven have also been supplied by the same firm, and are diagonal compound high pressure, both high and low pressure cylinders working on the same crank pin. The high pressure cylinder is 16 inches in diameter, that of the low pressure cylinder being 24 inches, and length of stroke 30 inches. In the former there is an expansion valve so arranged as to cut off the stroke at any point, from 5 inches to 20 inches, and which can be varied at will while the engines are working at full speed. They are regulated by Scott's Moncrieff patent governor. There will also be a small engine for the hoisting machinery in the grain store, and working separately. The architect of the building is Mr. W. Spence; while Mr. W. Young, flour mill engineer, has constructed and superintended the erection of all the varied and complicated mechanism of store and mill, with the exception of the engines, boilers, and millstones. Mr. Young's new cooler has been adopted here for the first time.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**Contents:**

(Illustrated articles are marked with an asterisk.)



## THE LIGHT OF COMING DAYS.

The light of other days—practical, not poetic—was the tallow dip, and, further back, a bunch of moss in a dish of grease. The advance from this primitive illuminator to the gas jet covers a most important stage in the progress of domestic economy. To make the illuminating material distribute itself was a capital stroke of policy. By most people it is regarded as the final stroke in the conflict with the shades of night. But it falls very far short of it.

Before we can truly say that our streets and houses are lighted scientifically, another and more important advance must be made. We must get rid of the offensive and poisonous products, the heat and flickering, the sharp contrasts of light and shade, the needless expense and frequent fires, and the thousand other disadvantages attending the distribution and local combustion of our illuminating material, by distributing instead pure light.

The problem is simple and easily solved. What we want in our rooms is a clean, white light, like diffused daylight. The popular mistake lies in supposing that the light must necessarily be generated where it is used. The remoteness of our natural illuminators ought to teach us the absurdity of such a position.

Every tyro in optics knows that light is the most tractable of material effects. It is obedient to the last degree. You can send it where you will, to any distance, through the crookedest channels, through the darkest passages, and it will emerge undimmed, ready to be absorbed or dispersed as the operator may wish.

It is well known also that there are many ways of producing a brilliant light, much more easily and economically than by carbon combustion in small and scattered flames. Yet, curiously, this familiar knowledge does not appear to have ever been put to practical use in producing a simple, wholesome, agreeable, scientific illumination for public and private buildings. To our children, the old fashioned candle snuffers are unknown, or known only as relics of an antiquated system of domestic economy. It is possible that, to their children, gas pipes may be equally obsolete as articles of household use, light tubes furnished with reflectors and terminal radiators taking their place.

The working of the predicted system can be sketched in few words. Given, say, a large hotel to be furnished with artificial light: Instead of having a network of gas pipes leading to the different rooms and to different burners in each room, according to the present method, the light for the entire building would be generated in one place, say in the main ventilating shaft for the utilizing of the surplus heat. The distribution of the light would be effected by means of reflectors, each throwing into its appropriate tube a bundle of rays (made parallel by a lens) sufficiently intense to flood the room to which they were directed with a pure white radiance, which could be turned on or off or graduated by simply pressing a knob or turning a key. In size, the light tubes need be no greater than ordinary gas pipes. Indeed they might be much smaller, since all the light required for the largest room might be transmitted to the reflector as an extremely slender beam. The terminal lenses would close the tube against smoke and dust, which would dim the reflectors at the angles; and by keeping the enclosed air pure and dry, the absorption of light would be inappreciable.

The advantages of this mode of illumination are many and obvious. There would be no poisoning of the atmosphere by local combustion; no scattered flames to occasion fires; no circulation of combustible material to encourage fire, should it happen to break out; children and careless servants would have nothing to handle that could possibly do damage; there would be no misplaced heat; no smoke or odor to sicken or annoy; no cross lights or flickerings to hurt the eyes. Besides, the lighting of a house would help to purify its atmosphere, instead of vitiating it as now, if the source of light were placed, as we have suggested, in the ventilating shaft; and, very likely, the economy of the light would be such that means for the instantaneous illumination of the entire house could be maintained at all hours of the night without costing more than our present imperfect and partial lighting does.

For churches, theaters, and other places of public resort, this method of lighting is specially available and inviting. The source of light might be in an absolutely fireproof vault or chamber, or in a separate building, so that the danger of accidental fires, with their attendant evils, would be reduced to the minimum. Similar advantages would attend its application to shipping. For mines, especially coal mines, it is unapproachable for simplicity and safety. Smoky torches and treacherous "safety lamps" might be entirely abolished, and the deepest pits flooded with white light, without flame tor he shadow of a risk of explosion.

## A CHANCE FOR INVENTORS.

While there is reason to doubt the possibility of devising an electric motor capable of doing heavy work as economically as the steam engine, there can be no question that, for light service, a satisfactory electric engine is one of the most widely felt needs of the age.

All that is lacking to meet this want is a suitable battery; in other words, a simple, compact, portable, and, if possible, dry apparatus, capable of generating a steady current of electricity for a considerable period without renewal, capable of standing unused without material waste, yet able to give out its full power on the instant when required, capable of being easily and cheaply kept in working order, free from fumes, and not liable to leak or spill its contents under ordinary circumstances.

The applications which await such a battery are practically innumerable.

Even with the fuming, slopping, troublesome batteries already in use, enough has been accomplished with electric motors to demonstrate the superiority of electricity for light work. Everything that steam can do in such cases it can do; and there are many occasions, domestic and otherwise, where steam power cannot be conveniently employed, where a small electric engine might do the required work quickly, neatly, without heat or risk of explosion, and without calling for special engineering skill or knowledge, the common lack of which must ever act as a bar to the general employment of steam for household service. And though the power obtained may be, in itself, many times more expensive than an equivalent amount of steam power, the advantages attending the use of electricity are so pronounced, the possible saving of time and trouble so great, that, with a generator such as we have described, there would be no hesitation in giving it the preference in thousands of cases where a little power is wanted for continuous work, or where there is occasional need of a small but instant effect.

Take, for example, that almost universal household necessity, the sewing machine. How immensely would its usefulness be increased by an acceptable means of running it: a motor which would require no winding up, which would not easily get out of order, which would be always safe, always ready, and perfectly under control! A man who should devise a battery to meet this demand alone would be sure of a fortune.

But this is only one of a countless number of uses to which such a battery might be put.

In almost every civilized home, there is water to pump, washing machines to operate, wood to saw, coal to lift, and a multitude of other labors, all of which might be done advantageously by simple electric motors, provided the requisite battery were forthcoming. Besides, there is light to furnish, doors and windows to guard against burglars, errands to run, and accidental fires to report. It is not impossible that the common dwelling house of the future will rival Houdan's in the diversity and completeness of its electrical appliances; yet, without entering the region of speculation or looking beyond the simple daily needs of ordinary households, there is a present call for the services of this fleetest, neatest, and most tractable of servants, sufficient to ensure wealth and renown to whoever shall capture and harness him satisfactorily.

For light manufacturing purposes, the call is equally urgent. In every workshop where steam is not used, there are presses, saws, lathes, drills, and numberless other present or possible machines, to which electro-motors might be profitably applied. For amateur workmen, nothing could be more desirable or more likely to meet with immediate acceptance. Then what an admirable contrivance it would be for driving light wagons or propelling pleasure boats! There would be no fuel to carry, no fire to watch, no possible explosion to fear: there would be no stabling or grooming to pay for, and no food to buy for the hours of idleness. Mr. Bergh ought to offer a premium for the invention, simply for the sake of the animals he loves.

Where the range of application is so great, it is needless to multiply examples. Our purpose is to suggest, not to demonstrate, the multitudinous uses to which a satisfactory electro-motor may be put, and to call the attention of inventors to the certain reward that will come to whoever shall overcome the last remaining obstacle.

## A CITY BUILT BY ONE MAN.

History affords numerous instances of the foundation of cities by single individuals, and the beautification and enlargement of portions of the same through the munificence of others; but nowhere, as we believe, is it recorded that any one man from his private fortune has ever attempted the actual construction of a complete town. All the more remarkable, therefore, is the enterprize which for some five years past has been quietly pursued by Mr. A. T. Stewart, a gentleman of whose immense wealth no accurate information has ever been made public. The high rates of taxation and the consequent exorbitant rents incident to ownership and occupation of dwellings in New York city have been the means of virtually banishing a large number of persons doing business therein, whose moderate incomes forbid the necessary expenditure, to the adjacent suburban districts. Hence arose a great demand for cheap homes; and as a result, village after village has sprung into existence in Long Island, New Jersey, and in fact at every point within a radius of forty miles of the metropolis.

Mr. Stewart, in view of this constant exodus of the city population, conceived the unique idea of building a model suburban city, where comfortable homes, provided with all modern improvements, could be obtained for a moderate outlay. Accordingly, he purchased a plot of land, ten thousand acres in extent and embracing that portion of Long Island known as Hempstead Plains. This is in a compact tract of about ten miles in length by one mile in width, and nearly a perfect parallelogram in shape. Surveying and staking out the new city followed close upon the acquisition of the ground, and the first work taken in hand was the making of streets and avenues, with pavements, sewers, culverts and conduits, for blocks of buildings yet to be erected. Simultaneous with laying the foundations of the houses, was the commencement of gas and water works, and of a railroad connecting the city with New York. Unlike the usual course adopted in projecting new towns in the vicinity of the metropolis, no lots were advertised; nor has any attempt been made to dispose of the property, as it is the intention to treat the city as a single house, finishing it first, and selling it subsequently. The New York *Sun* aptly describes the enterprize as a new city springing up, with no Mayor or Council, no assessments for street improvements, no taxes for water and gas, no entangling alliances or issuing of bonds to secure railroad transportation, no scrambling or grumbling to secure immigrants.

An admirably kept hotel, situated in the middle of a fine garden plot, together with some forty houses, are thus far complete. The latter are located in lots of 200x200 feet and provided with outhouses and handsomely laid out grounds. They rent for from $250 to $800 per year on three year leases, and contain every convenience found in the best city dwellings. Work upon this remarkable town, to which the name of Garden City has been given, is rapidly progressing, and we understand that the advantages offered are meeting with a wide popular appreciation.

GERMAN RAILWAYS.—It appears that, in consequence of the increased cost of railway working in Germany, as well as in other parts of the world, the rate of interest realized, on the capital expended on first establishment account, declined last year to 4·4 per cent. In 1869, the corresponding return stood at 6·4 per cent. An augmentation of 16 per cent in goods rates is required in order to secure an average interest of 5½ per cent on the capital expended.

### FIRE DAMP EXPLOSIONS PRODUCED BY SOUND.

The paper recently read by Mr. William Galloway, Inspector of Mines, before the English Royal Society, is a valuable and important contribution, marking, we trust, the beginning of further investigations into the prevention of the accidents and large loss of life in mines, due to explosions of fire damp. The Davy safety lamp has been heretofore considered safe under all circumstances except when exposed to the action of an explosive current, when the flame might be driven through the meshes of the wire gauze and so cause an explosion. But disasters occurring in British collieries where the lamp was used becoming too frequent to be reasonably ascribed to the existence of the above exceptional conditions, various theories have been suggested; and in cases where no plausible ground for the same could be found, carelessness of workmen appears to have been the general assumption.

In the year 1866, a great explosion, occurring in the Oaks Colliery, happened simultaneously with the firing of a heavily charged shot in pure air. Attention was drawn to the coincidence; and from examination of the reports of the mine inspectors, it was found that shot firing was carried on in seventeen of the twenty-two collieries in which explosions had happened since the date of that above mentioned, and the details given prove that shots were fired at or about the time of each disaster.

In 1872 Mr. Galloway conceived the idea that a sound wave, originated by a blown out shot, in passing through a safety lamp burning in an explosive mixture, would carry the flame through the meshes of the wire gauze in virtue of the vibration of the molecules of the explosive gas; and to test this view, he instituted a series of experiments under the auspices of the Royal Society which adduced perfectly conclusive results.

We find in *Nature* a record of these interesting trials. The first consisted in directing a slow current of gas and air from a Bunsen burner through a sheet of wire gauze inclined at an angle of 70°. Part of the explosive mixture passed through the gauze and produced a flat flame. A glass tube, 3 feet 4 inches long and 3½ inches in diameter, was placed horizontally with one end opposite the flame on the same side of the wire gauze, and distant from it about 1½ inches. At the other end of this tube, a sound wave was produced by exploding a mixture of coal gas and oxygen contained in bubbles. When the sound wave passed through the tube, the flame was carried through the gauze and ignited the gas in the Bunsen burner on the other side. Paper and other diaphragms, inserted at a distance of 10 feet from the origin of disturbance, ensured that only the sound wave was propagated through the tube.

More elaborate apparatus was then constructed, so arranged that the sound wave of a pistol shot was conveyed through tin plate tubes to a distance of about 20 feet, where it passed through a safety lamp burning in an explosive mixture. The Davy, Clanny, Stephenson, Mueller, and Elvin lamps were all tested, with, however, the results that, while the flame passed easily through the Davy lamp, it passed with more difficulty through the Clanny, and not at all through any of the others.

After this, experiments were made on a larger scale in a sewer, where it was found that 109 feet was the greatest distance a sound wave could be propagated of sufficient intensity to pass the flame, when caused by the discharge of a pistol loaded with 59 grains of powder. The sewer was built of brick, and was 6 feet high by 4 feet wide.

Mr. Galloway's discovery, that, when the vibration of the air which constitutes a sound wave has a certain amplitude, it can transmit flame through the wire gauze of the Davy and Clanny lamps, furnishes an additional argument against trusting the lamps in use among ordinary workmen. It is now almost universally admitted, says the discoverer's paper in conclusion, to be highly dangerous to continue work in an explosive atmosphere; so that safety lamps should be used only as a precaution against possible outbursts of gas, or when work is carried on in the neighborhood of gas that cannot be easily dislodged; it is evident therefore that lamps, constructed on the principle of the "safety lantern," such as the Stephenson, Mueller, etc., which are extinguished in an explosive mixture, are far safer than lamps like the Davy and Clanny, which continue to burn under the same circumstances, and are then liable at any instant to have the flame driven through the wire gauze, and communicated to the external explosive atmosphere.

### PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

This association opened, on August 12, its twenty-third session, at Hartford, Conn., under the presidency of Dr. J. L. LeConte, of Philadelphia. Judging from the numbers, as well as the high standing of the attending members, the meeting bids fair to be one of much interest. The President, in his

#### OPENING ADDRESS,

said that the past year was noteworthy for four events. The first was the appearance of Coggia's comet, from the spectroscopic examination of which the happiest results may be expected. Already the spectroscope has proven to us that even though the largest of comets should strike the earth no possible harm could ensue. We may learn that our planet has been in fact benefited by occasional collisions and absorptions. The second event is the establishment of the Anderson School, at Penikese, for instruction in Natural History. The facts connected with the organization of this school, and its munificent endowment by Mr. Anderson, were briefly rehearsed. The third event of the year is the act of Philadelphia in the establishment of a zoological garden. The last event is the introduction into the United States of civil hospitals built on the plan which is known in every other civilized nation as the American system.

The matters of interest that were to come up before the Association were then briefly summarized, chief among which was the adoption of a new constitution.

The formal opening of the session included a speech from the chairman of the Local Committee, Hon. H. C. Robinson, and a reply by President LeConte. The work of organizing was then proceeded with, and the officers of the various sections elected.

We give below our usual abstracts of the papers thus far read:

Professor H. P. Armsby, of Millbury, Mass., on the subject of

#### THE NITROGEN OF THE SOIL,

said that it has become an important problem in agricultural chemistry to ascertain the source whence plants derive their supply of that element. Lawes, Gilbert, and Pugh showed that the cereals, at least, are incapable of assimilating free nitrogen from the air; and this is probably true of all plants. The author made a series of experiments to throw light upon the loss and gain of nitrogen, the method adopted being to allow organic matter, containing a known amount of nitrogen, to decay under circumstances in which all the nitrogen given off or accumulated could be measured. The results show a loss of nitrogen in nearly all cases. The following conclusions sum up our present knowledge: 1. The loss of free nitrogen during the decomposition of nitrogenous organic matter is generally due to oxidizing action. 2. An increase of combined nitrogen in soil may take place by oxidation of free nitrogen to nitric acid. 3. Some organic substances in the presence of a caustic alkali are able to fix free nitrogen without the agency of oxygen or the formation of nitric acid.

The results of Professor Pliny Earle Chase's communication, on

#### THE VELOCITY OF PRIMARY UNDULATION,

are that, adopting Struve's constant of aberration, we find that the constant velocity which would account for all the gravitating motions of the solar system is almost, if not exactly, identical with the velocity of light. The well known thermodynamic principles which point to a gaseous structure of the sun seem to be confirmed by this investigation. The following relationship may, perhaps, prove to be something more than merely curious: The number of vibrations in the unit of time of the mean thermodynamic rays is very nearly, if not exactly, equivalent to the cube of twice the sun's mass divided by Jupiter's mass.

Professor E. T. Cox, State Geologist of Indiana, followed with an account of an ancient stone fort, existing in Clarke county, Ind. It is a relic of the moundbuilders, and presents some peculiar features of construction adapting it excellently for a defensive work.

Professor A. S. Packard, Jr., read a paper on the

#### CAVE FAUNA OF THE MIDDLE STATES.

The results show a great uniformity in the distribution of life—more than would at first be expected, though these caves lie in a faunal region nearly identical as regards the external world, and the temperature of the caves is very constant. Still some notable differences occurred.

The basis of life in the caves is without much doubt the living and decaying animals found in them. While 25 to 30 species were known to inhabit our caves, chiefly through the labors of Tellkampf, Cope, Cooke, Dr. Sloan and others, we are now able to add 50 species to the number, which will probably be carried up to 100.

#### DIFFERENCES IN SOLAR HEAT.

Professor J. P. Langley remarked that there is a variation in both the heat and light, and probably also in the actinic force, of different parts of the sun. The difference is due principally, but not wholly, to difference in atmospheric absorption.

It does not appear, as the result of experiments, that there is so great a selective absorption of heat, in the lower regions of the sun's atmosphere, that, when rays come from the edge of the disk and pass through a greater proportional thickness of his atmosphere, the heat is filtered from them and the light allowed to go through. We find that the heat falls so very rapidly toward the edge as to indicate a much greater thinness, of the solar chromosphere, than has been hitherto admitted. We appear to have been led to the conclusion that there is a local obscuration over the spot, very remarkable both in degree and kind.

Professor E. S. Morse, in a paper on the

#### NORTH AMERICAN UNIONIDÆ

explained why the unios or fresh water mussels are so much more abundant in the United States than in Europe. He emphasized particularly the fact that most fresh water families of mollusks were closely related to those families in the sea which survive the admixture of fresh water, and that commonly occur between high and low water marks.

Professor LeConte gave an interesting account of the rite of cremation as practiced among the Yuma Indians, and noted among other proceedings the removal of the eyes of the deceased, which were put on pointed sticks and held out toward the sun. This indicates a feeble remnant of the widely diffused sun worship of former times.

Professor Lovering, President at the last meeting of the Association, read an address on

#### RECENT ADVANCES IN SCIENCE.

Wheatstone, he said, by a revolving mirror, determined the velocity of electricity, the duration of electrical discharges, and the duality in the direction of the transmitted disturbance. Feddersen, and more recently our own associate, Rood, repeated his experiments. Indirectly the velocity of electricity thus ascertained (and the greatest known except that of gravitation) has been tested by signals through long lines of land and ocean telegraph, giving a lower figure than that of Wheatstone. But the anomaly is due to a misinterpretation. That electricity moves through a quarter of a mile of wire at the rate of 288,000 in a second is not evidence that it would move over 288,000 miles in one second. Electricity has no velocity in the ordinary sense. The transmission of the electrical disturbance is proportional to the square of the distance to be traveled; therefore the velocity varies with the length of the journey.

Had the results of Ohm been sooner heeded, Science would have long ago been materially advanced. Arago, making use of Wheatstone's method, proved experimentally that the velocity of light was greater in air than in water, giving a fatal blow to the corpuscular theory of light and establishing the undulatory theory. The mean of the two values obtained for the velocity of light in the experiments of Fizeau and Foucault, comes very close to the astronomical estimate. Cornu has repeated Fizeau's experiment, eliminated its errors, and brought it into accord with Foucault.

Foucault's experiments intensified the doubt that astronomers had long entertained as to correctness of the received distance of the sun. The "black drop" in the transit of Venus has been found the basis of uncertainty. Mr. Stone, an astronomer, has examined this source of error, and, by calculations that give due weight to this source of discrepancy, has suddenly brought about a reconciliation between the experiments of Cornu and Foucault, the motions of the moon and the transit of Venus, which is as perfect as it is surprising.

In reviewing the advances of natural history, Professor Lovering spoke of the discoveries in that science made by Maupertuis and Lamarck, and considered them in connection with the nebular hypothesis as originated by Laplace and carried forward by the elder Herschel. The fate of the nebular hypothesis is as yet uncertain, but it will answer the purposes of Science till a better theory is brought forward.

The motion of the fixed stars involves a most interesting inquiry. A motion has been observed, absolute in the case of the sun, and capable of estimate in the different stars as fast as their distances are determined. Here again spectroscopy has come to our aid. The alteration of wave lengths of light, by the motion of the observer or the object observed, has helped and is helping to solve this problem. This discovery was then historically reviewed, going back to the discovery of the velocity of light by observations on the calculations of Vogel and Huggins on the displacement of star spectra, which are to be received as somewhat doubtful approximations. There is, too, the possibility that the misplacing of the lines of sodium, hydrogen, and other elements may be due to conditions different from any we know on earth in the gaseous atmospheres of the stars.

The observations of Huggins on star drift open a new series of questions, and may possibly throw discredit upon the accepted estimates of star distances, made independently by Struve and Argelander. Van der Willigen, in the present year, has published a well considered memoir on the fallacies which he regards as vitiating the conclusions of Huggins. Except under certain improbable conditions, he shows that the motion of the luminary will not interfere with the time of oscillation. If this be accepted, the supposed motion of the stars must receive another interpretation. On the other hand, if the motion of a luminary is ascertained, and it is found to accord with spectrum displacement, the mathematical theory will have to be reconsidered.

Professor Challis, in an elaborate work, has discussed the interplay between ether and atoms, and the theory may now be regarded no longer as a speculation, but as a physical reality, with substantial mathematical supports. He does not yet claim full mathematical proof, but his work is a guide post that unmistakably points the way. In one respect the theories of Le Sage and Challis coincide: the driving storm of atoms must come from outside the world of stars; the universe is not even temporarily automatic, but must be fed continuously by an agency external to itself. Our Science thus is not a finality.

The law of conservation of energy, the child of the correlation of physical forces, was then considered in a brief historical review. Physical science can only assert that it possesses no evidence of the destruction of matter. We have no conception of inert matter or disembodied force. All we know of matter is its pressure and its motion. If it could be shown that all the phenomena displayed in the physical world were simply transmutations of the original energy existing in the molecules, physical science would be satisfied.

The great problem of the day is how to subject all physical phenomena to dynamical laws. The obstacles are innumerable, but we shall not rest till they are overcome. We applaud with good reason the brilliant results of experimental research, but mathematical analysis, with its multitudinous applications, is the only key which will fit the intricate wards in the treasury of Science.

A CORRESPONDENT, C. R., says: A worn out watch key can be made as good as new by simply filing off about $\frac{3}{16}$ of an inch of the end, as the socket is usually twice as deep as the post of the watch is high.

## A PORTABLE RAILWAY.

We give herewith two illustrations representing a novel portable railway, lately devised in France by M. Corbin. The invention is one having a wide range of applications, since it may be employed in any locality about which it is desirable to transport masses of bulky material. Our engravings, which we extract from the *Moniteur Industriel Belge*, show the railway in use in a brickyard and also in a harvest field.

The track used is of wood, and consists simply in longitudinal pieces joined by cross bars, and made in lengths of a size to be easily transported. These are laid in position wherever required, and serve as ways for the trucks, which are nothing more than rectangular platforms, having a pair of small wheels at one end and an attaching apparatus at the other. A number of these vehicles are joined together to form a train. In brickyards the bricks are piled directly upon the platforms as shown in the engraving. In the gathering of agricultural products, baskets are employed, which are carried to various portions of the field, and thence taken to the trucks for transportation.

The inventor says that, with ten trucks and twenty baskets, half of the latter being constantly in use, four workmen can pull and transport, to a distance of 800 feet, 40 tuns of beets or like vegetables in a day. One man, he adds, can easily draw the ten loaded trucks, with over a tun of contents, along the ways.

The railway is excellently adapted for transporting material over soft or plowed ground, and might be used in all operations requiring the removal of stone and earth. With the aid of a horse, a still larger number of trucks than above mentioned may be moved at once.

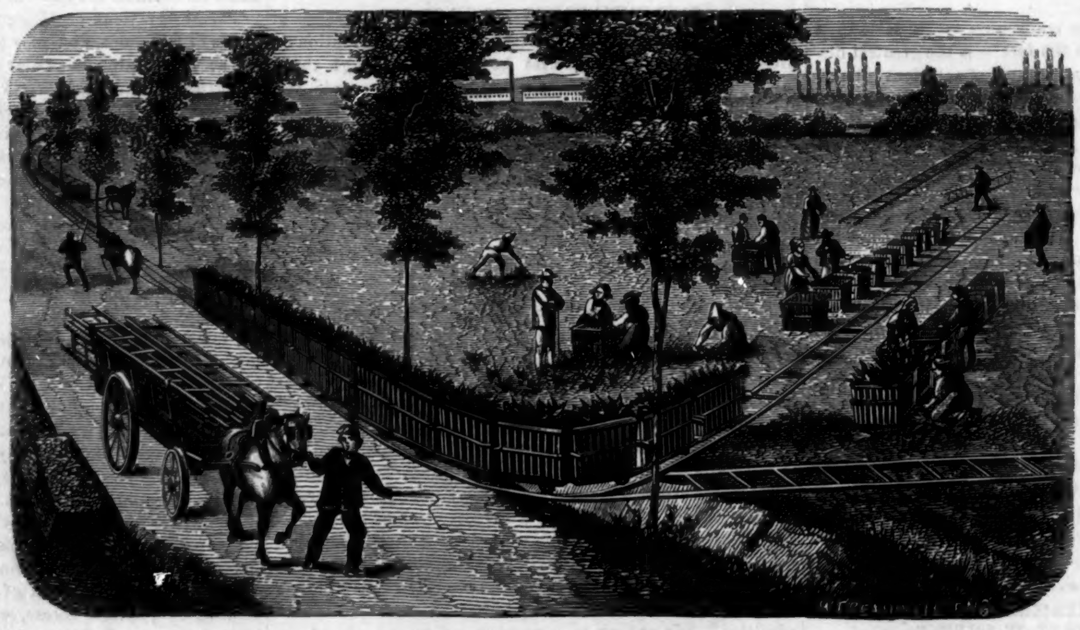
PORTABLE RAILWAY IN A BRICKYARD.

### Foundery Charcoal.

The part which the charcoal plays in the molds is to give porosity and facilitate the escape of the gases and steam caused by the molten metal. There are three sorts in use in French founderies, known as mineral charcoal, vegetable charcoal, and stove charcoal. The first of these is made from coal finely pulverized, and is mixed with the sand used for casting pieces of small dimensions and little thickness; these molds are called green sand molds. But all sorts of coal are not equally good for the purpose; some kinds give a white appearance to cast iron, and produce on the surface, and chiefly at the extremities of the castings, rough spots which the file will not touch, and which have the appearance of having been run at too low a heat. M. Maillfert has tried many kinds and finds that *gras* or bituminous coal is the best, and says that, when used in small quantities and finely sifted, its action is perfect, and it gives to the casting that bluish luster which is highly esteemed.

The vegetable charcoal is made from carefully selected wood, burnt in a special manner. The principal quality required in it is that it should not catch fire, and it is used principally for powdering the surface of the mold so as to prevent the contact of the molten metal with the green sand. It is reduced to such impalpable powder that the spatula used for spreading it in the mold gives it a surface almost as brilliant as glass; it is called *gras* or fat charcoal, a quality derived from the mode of burning, and it will neither roll before the trowel or spatula nor stick to it.

Stove black is used for the same purpose in the case of large castings, as the other kind will not bear excessive heat. This is simply mixed with water and applied rather thinly. A thick coating is not considered good.



PORTABLE RAILWAY IN A HARVEST FIELD.

### The Remarkable Quicksilver Mines of Colusa County, Cal.

The Elgin mine is as yet undeveloped, but the richness of the prospect is self-evident. Everywhere seams of the richest ore are revealed to view, and ere long it will turn out to be one of the richest mines in that vicinity. The Elgin company opened their mine about six months ago, and have now a force of ten men, together with a retort, from which they run four flasks per week. They are busily engaged in running tunnels, and ere long we will hear of a big strike for the Elgin. This mine is under the superintendence of J. Melbourne. While we were present, they ran off a retort of 84½ per cent ore.

The Abbot in richness is undoubted. Ten experienced miners are continually employed in extracting furnace ore, and the work goes on night and day. They are now busily preparing to build a furnace at a cost of $10,000.

The Buckeye is the best developed mine in this region. Seams of the richest cinnabar are plainly visible wherever the eye glances, and from this mine very little waste rock is extracted. The Buckeye runs a force of twenty eight men steadily, and retorts weekly fifteen flasks of quicksilver. A flask is considered worth $100.

The Empire is a new and rich prospect, struck but a month ago. The value of this mine is in the small amount of labor necessary to work it, it being all clay soil, composed of magnesia, lime, and cinnabar.

The mines in this section of our county excel all we have seen in richness. The very best ores, which will average 30 per cent, are found on the surface of the hills.

A WONDERFUL GAS WELL.

We cannot forget, says the Colusa *Independent*, to make mention of the gas fire which issues from the mountain in close proximity to the Elgin mine. The side of a hill is all ablaze, and has been so for eight years, when fire was communicated, to the gas which emitted, by M. G. L. Eaton, and has been burning steadily ever since. This accrues enormously to the richness of the Elgin, as they can run their furnace with little or no expense. An escape is now taking place of 125 cubic feet, sufficient to run a dozen furnaces.

This portion of our county abounds in quicksilver wealth, and those owning mines will at first have to encounter difficulties, but ere long they will overcome the hardships of developing their mines; and in all experience with regard to mineral wealth, Colusa has the richest.

### Holborn Viaduct Station, London.

This commodious station is at once an important addition to the railway accommodation of the city of London, and one of the most notable among the many remarkable transformations that have occurred.

The construction of the station was commenced in February, 1872, and necessitated the removal of a large area of old buildings that were alike unsightly and unsavory.

The works were designed by Mr. W. Mills, C. E., engineer-in-chief of the London, Chatham, and Dover Railway.

The station works commence at Ludgate railway bridge, and extend for the low level through lines to a point on the north side of Holborn Viaduct, on which the low level station is situated, with entrances from the viaduct and from Snow hill. At the end of the Ludgate bridge the four lines of the Chatham Company diverge, two lines being carried to the high level terminus, at which they spread out to seven lines, and an engine line. Two lines descend by the low level to the Metropolitan underground system. The rails at the bridge are 59 feet above Ordnance datum; at the platform they are 4 feet higher. The ascent is by a gradient of 1 in 100 for 400 feet; thereafter the rails are level for about 900 feet. The descent to the low level is by a gradient of about 1 in 40.

One of the remarkable features of the works is the extraordinary strength of the piers and girders that bear the west end of the superstructure that faces the Viaduct. The piers that carry girders have first of all beds of concrete about 7 feet thick resting upon the London clay. The foundations are 19 feet by 16 feet at the base and are built first of beds 2 feet thick, of gault brick, diminishing upwards to the dimension of 11 feet of Staffordshire blue brick for 4 feet in hight; again, to a width of 7 feet 3 inches, and, finally, they are contracted to the massive stone piers of 3 feet 9 inches on the side. There are five of these piers in all; they and the girders are so constructed and placed as to admit of a future widening of the road by the addition of other two lines of rails. The box girders that carry the end of the hotel above are 5 feet by 3 feet 9 inches dimensions, and weigh each about 45 tuns. The extreme length, supported in the center, is 74 feet; the maximum span is 30 feet continuous. The girders—which weigh about 400 tuns in all—were placed in their respective positions without any interruption to the traffic.

The high level station is about 750 feet in length by 137 feet in width. The roof, in three bays, is on lattice girders, and supported upon three ranges of columns of twelve each, 21 feet high. There are ornamental iron spandrils at the heads of the columns. The angularities of the station area are covered in with lateral Paxton roofs. The cab approach is by a winding entrance after the manner of Charing Cross station, from Farringdon street and Bear lane; the exit is by the front from the arrival platform to the viaduct. Lifts are provided at convenient points for the interchange of luggage between the high and low level platforms, between which excellent communications are also provided for passengers. The ground floor of the front building is appropriated to booking offices, station master's office, waiting rooms, restaurant, and other accommodation required for the traffic. A communication is open with the hotel at the east end of the cross platform. The main front building has a façade 235 feet long, of which 182 feet by 29 feet is a covered fore court to the station, with a range of arched openings to the street. It is roofed with transverse arches, filled in with white glazed tiles, and, for the carriage way, paved with Charley Forest 3 inch cubes, with a foot pavement along the inner sides and the ends of the court. A massive trussed cornice is carried along the front over the arched openings, which are closed at the bottom by a balustrade. Gas lights, with an ornamental wrought iron railing, will be fitted on the coping of the balustrade. Ornamental pateras are introduced in the spandrils of the arches.

The station roofs give abundant light by the broad belts at the ridges that are filled with 21 oz. rolled plate glass. Appliances for ventilation by louvre openings are also very complete.

The arches beneath the high level station are utilized by the Company for stables.

### FABRIC PRINTING MACHINE.

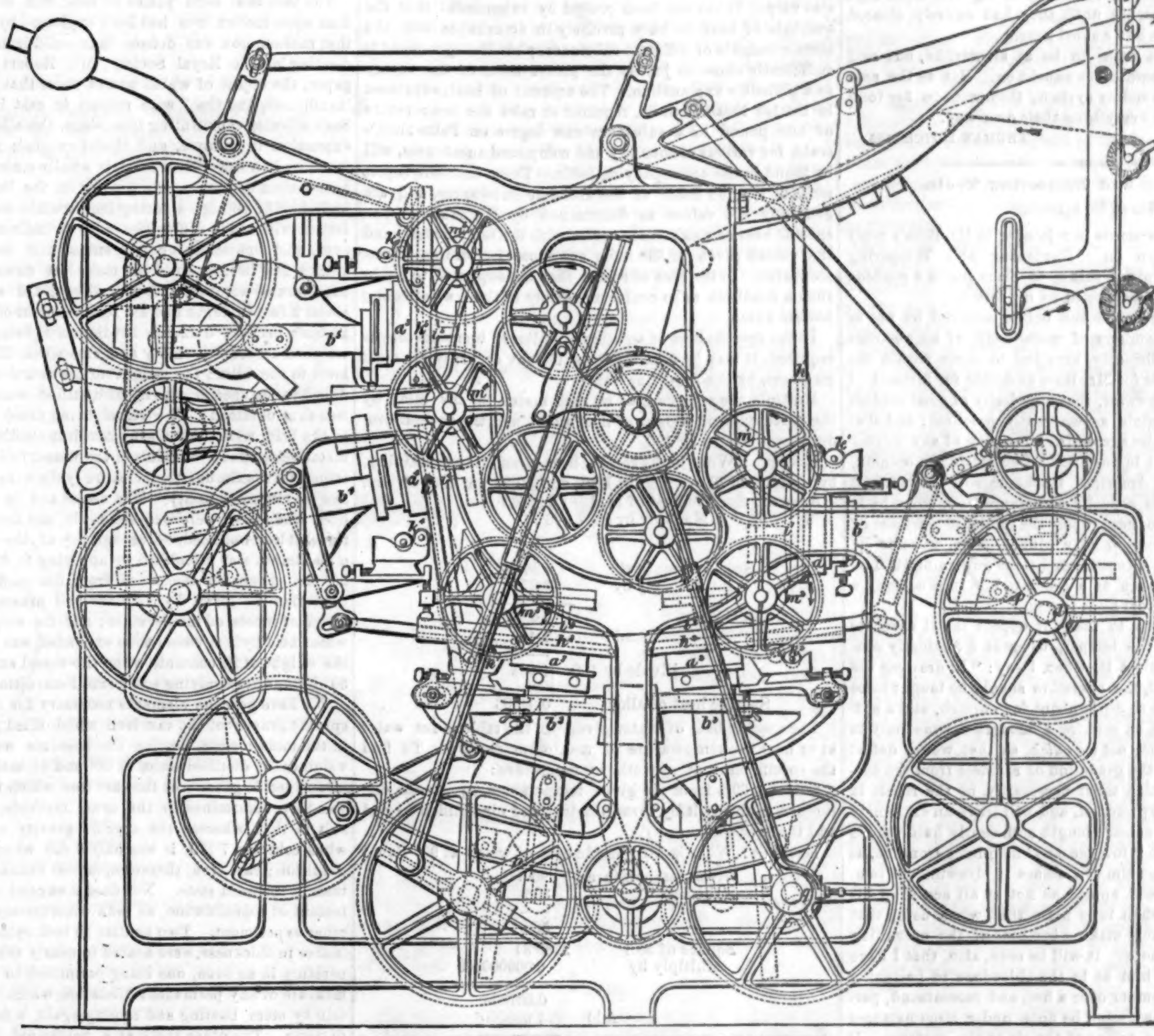
We present herewith an engraving of a machine for printing textile fabrics in eight colors, the invention of Herr C. Bialon, of Berlin, Germany. It is of the form known to calico printers as a perrotine, a term used to distinguish those presses in which the printing is effected by flat forms which produce an embossed design, thus imitating the work of hand printing. *Engineering*, from which we copy the illustration, describes it as follows:

$a_1\, a_2\, a_3\, a_4\, a_5$ are the forms, fastened to iron supports, which are carried by the pressure bars, $b_1\, b_2\, b_3\, b_4\, b_5$. These latter execute an interference motion, which, as may be examined in the case of the pressure bar, $b_1$, is produced by the two crank pins, *c* and *d*—of which *c* makes twice as many revolutions in a given time as *d*,—by the joint levers, *e* and *f*, and the stay or frame, *g*. Through the rotation of the crank pins, *c* and *d*, the forms are at first fully drawn back, while, by means of a special combination of levers, all the color plates, *h*, are placed between the forms, $a_1\, a_2\, a_3\, a_4\, a_5$, and the printing tables, $i_1\, i_2\, i_3\, i_4\, i_5$. The color plates are flat cast iron plates covered with an elastic material, upon which color is transferred while passing the color rollers, $k_1\, k_2\, k_3\, k_4\, k_5$. The printing tables, which are also covered with an elastic material, serve as a support for the stuff during the operation of the printing. The stuff to be printed is rolled off the beam, *l*, and passing over one stretching roller, three stretching bars, and a wooden guide roller, is carried by means of the needle rollers, $m_1\, m_2\, m_3\, m_4\, m_5$, over the printing tables, passing out of the machine at *w*, and being then led off to a drying apparatus. With a further rotation of the crank pins, the pressure bars advance so far only that the forms touch the color plates, the embossed designs of the former thus being caused to receive color from the latter. The pressure bars, $b_1\, b_2\, b_3\, b_4\, b_5$, are now withdrawn with the form covered with color, while the color plates pass back in the meantime to the coloring apparatus, where they receive a fresh supply. Another rotation of the crank pins advances the forms close to the printing table, and presses the design covered with color upon the stuff in front of the printing tables. After this operation the forms are drawn back, the color plates are again placed between the forms and the printing tables, and the same operations are repeated during the following rotations of the crank pins.

During the time the coloring plates are moved up and down again, or, in other words, during the time in which the forms are not in contact with the stuff, the latter advances as much as the width of the form (length of guide), so that the next impression takes place close behind the one previously executed. The stuff is moved forward by means of the guide mechanism, while the five needle rollers, $m_1\, m_2\, m_3\, m_4\, m_5$, are moved by means of spur wheels gearing into the main guide wheel, *n*; this latter is put in rotation by the rack, *o*, and the wheel, *p*, but only in the direction indicated by the arrow, the wheel, *n*, not being moved when the rack is drawn back; this effect is attained by transferring the motion by means of a ratchet with wheel and brake. In order to shift the stuff exactly as much as required by the width of the form, the rack has to be adjusted for each width, and the position of the draw pin of the former, with respect to the center of the wheel, *p*, has to be altered accordingly, for which purpose the sliding piece is provided with a scale.

By a special contrivance it is rendered possible to cause each form to strike the stuff on one and the same place twice successively, after having taken up color in the intermediate time. This is accomplished by throwing the guide motion out of gear between the first and second print, whence the stuff remains in the same position during the two impressions. For this purpose the shaft, *q*, carries in front of the spur wheel an eccentric, which transfers during one revolution of the shaft, *q*, an oscillating motion to the lever, *r*, with its fulcrum at *s*, while at the following revolution the lever is kept in its position. In this manner the short arm of the lever, *r*, moves a conical slide, disengaging the trigger or catch which transfers the motion from the main guide wheel, *n*, through the spur wheels to the needle rollers, whence the latter are prevented from rotating. If the lever, *r*, passes back again into its original position, the guide again follows the action of the rack. This arrangement facilitates finishing heavy stuffs, of which large surfaces have to be printed uniformly with color, in a clear and proper manner.

These machines are constructed for one, two, three, four, and five colors, and nearly 500 of them have been supplied to Germany, Switzerland, Austria, Russia, England, and this country. They are preferred to the cylinder printing machines, on account of the flat forms being considerably cheaper to produce than the engraved copper rollers of the cylinder machines, and on account of their being readily worked by manual power, while the cylinder printing machines require steam or other motors.



IMPROVED FABRIC PRINTING MACHINE.

### SCIENTIFIC AND PRACTICAL INFORMATION.

#### MACHINE FOR DRYING SEWAGE.

In preparing town sewage so as to render it available for fertilizing purposes, the most difficult part of the precipitation process is the drying of the deposit after the superfluous defecated water has been allowed to run off. Messrs. Milburn & Co., of Hatcham Iron Works, England, have, we learn from *Iron*, recently introduced a new machine for this purpose, which has given excellent results. The General Sewage and Manure Company of Whitby use the apparatus as follows: The sewage is first strained, then mixed with a chemical solution and partially defecated. Milk of lime is added, and precipitation takes place in large tanks. The precipitate drawn off from the latter goes to drying rooms, and thence is lifted by elevators so as to flow into the machine. This is composed of a floor of iron heated by a fire under the feeding end. On the floor is a frame carrying a series of transverse scrapers which are so arranged as to revolve and scrape the bed. Their construction is also such that from each scraper, at its return stroke, a portion of the sludge is passed to the next scraper; so that the material travels the length of the floor, and emerges dry and pulverized. The heated air passes first under the floor and then over it. The machine is self-feeding, self-acting, and easily adjusted; it requires very little power to work it, and produces from three to four tuns of dried manure per day of twenty-four hours, with a consumption of one tun of common slack coal.

#### QUICK REMEDY FOR SUNSTROKE.

Thirty or forty years ago, when our cities were not so crowded with ignorant laborers as now, and when ice water was almost unknown, there were but few cases of sunstroke. Yet, occasionally a native farm hand in the haying field would get overheated and chilled, and become senseless. A good doctor of that period used to use the following simple remedy in such cases, and never failed to restore the sufferer: As soon as possible, he poured a teaspoonful of laudanum down the man's throat; and in a very brief time, the sweat would start out and the man begin to revive. The quickness with which laudanum produces perspiration is remarkable.

#### A NEW NIAGARA BRIDGE.

Surveys are now in progress for a new bridge to cross the Niagara river just below Black Creek. The structure is erected in the interest of the Canada Southern Railroad in order to render that line independent of the present single track bridge, and also to allow its trains to go around Buffalo instead of passing through the city at slow speed. Suitable branch roads, connecting with the Erie and Central lines, will be built to carry out this purpose. The new bridge is to have a double track and double carriage, and will be completed, it is expected, in August, 1875.

#### THE WELLAND CANAL IMPROVEMENTS.

Canada is evidently omitting no effort in her plans for diverting our Western trade through her highways. The improvements now contemplated upon the Welland Canal include an entirely new and separate canal from Marlott's Pond, above Thorold, to Port Dalhousie; while from the Pond to Lake Erie the old work will be enlarged. The new line will be a trifle shorter than the old one, and will have one lock less. The average depth of water will be fourteen feet, so that, as regards the capacity of sailing vessels and propellers, Lake Ontario will be placed on a par with Lake Erie.

## Correspondence.

### The Ant's Instinct.

*To the Editor of the Scientific American:*

I sailed from Philadelphia in the winter of 1859, having on board a cargo of lumber. After being at sea some ten days or more, I discovered that we had on board a large number of passengers, ants and cockroaches. Going through the cabin one evening, our colored steward said to me, "Cap'n, jes' look a-hea'h." He was standing in the pantry door with a lamp in his hand. On looking into the pantry, I discovered on the lower shelf a number of large black ants in a huddle, and a half dozen by themselves, and on the opposite side of the shelf was some sugar which the ants did not seem to notice, which caused me to wonder; the reason, however, soon became apparent. A cockroach made his appearance and went for the sugar; and the group of ants went for him, and, before he fairly got a taste of the sugar, they had him down and killed him in less than a minute; then the six that stood apart from the rest advanced, took up the dead cockroach, and bore him off the field. The others remained on the watch, and as soon as another appeared they all pitched in and made short work, as before. In the meantime, the pall bearers had returned and took this one off the field, as they had done the other. I watched until I saw this enacted a half dozen times, and it was done as regularly as it could have been by men. The ants kept on killing the cockroaches until they had entirely cleared them out, which took but a short time.

Cockroaches do not seem to be at all warlike, but raid about in quest of something to subsist on. But as the ants do not believe in the moiety system, they went in for total annihilation, and had everything their own way.

Stratford, Conn. TRUMAN HOTCHKISS.

### Hardening and Tempering Tools.

*To the Editor of the Scientific American:*

I desire to say a few words in rejoinder to Mr. Rose's reply to my communication on "Hardening and Tempering Tools," as he attempts, I think, to place me in a position very far from what is warranted by my letter.

To be satisfied to consider the points adduced by me as something of the chemistry of metallurgy, of an abstruse nature, and not sufficiently practical to come within the scope of his articles, is for Mr. Rose to decide for himself. I am of the opinion, however, that a majority of your readers will regard these points as eminently practical; and that their observation, in the successful tempering of any cutting tool, is of very great importance. I entertain the opinion, too, that our average American mechanic will not think it something beyond his capacity to comprehend, when he is told that the color produced upon the polished surfaces of steel is due to the formation of a film of oxide, or when he is instructed as to the essential conditions governing its formation, when it is taken as a guide to him in producing a required temper in a tool he is to use.

Mr. Rose would seem to make it appear that I advocate the rapid drawing of the temper, whereas I distinctly caution the operative against it, when I say: "In drawing the temper of such a tool, the operative should be taught to be as careful as possible to dip it about far enough, and a sufficient length of time, to require a moderate time only to bring the proper color; *not too quick*, as that would defeat his object by causing the gradation of softness from the cutting edge upward, which must necessarily be the result in this method, to be very sudden, and will leave an extremely small fraction of the chisel's length sufficiently hard for his purpose." Again, the "few seconds" he quotes from me, as representing the proper time to elapse in drawing the temper of a cold chisel, will appear as not at all acute on his part, if indeed fair, when it is plain that, when using that expression, I was merely making instance of the prevailing malpractice of the shops. It will be seen, also, that I have entirely agreed with him as to the objections to hastening the drawing of the temper over a fire, and recommend, particularly, that such hastening be done under circumstances which will insure free access of the air to the surfaces. If Mr. Rose is content to accept any process which predicates the temper upon the color of the film, and which at the same time excludes the air from the surfaces upon which the film is to form, as instanced in the sand bath, he is welcome. The fact is that the time taken in the formation of the film of oxide, as well as the free access of the oxygen of the air to the surfaces, are very important points, and, moreover, extremely practical; and Mr. Rose will do well not to ignore them. JOHN T. HAWKINS.

53 Cannon street, New York city.

[For the Scientific American.]

### SPECIFIC HEAT.

BY RICHARD H. BUEL.

It is well known, as a matter of fact, that the amounts of heat contained in equal weights of different substances vary greatly. For instance, the amount of heat required to raise the temperature of one pound of water from 32° to 212° Fah. will raise the temperature of about 30 pounds of mercury through the same range. The reason for this fact is not known; but there are several explanations given, the most generally received being that which is based on the modern theory of heat. A short description of this explanation may not be uninteresting. Experience teaches that every known substance is divisible; but it seems reasonable to suppose that if the division be continued far enough, the ultimate particles will at last be reached, which cannot be subdivided without losing their properties as parts of the given substance. These ultimate particles are called the molecules of the body; hence a molecule may be defined as the smallest particle of a body which possesses all the properties of that body. The molecule may be broken up into its constituent elements, by some chemical process, and the particles obtained by the decomposition of the molecule are called atoms. It is supposed that the volume of a molecule is about two billionths of a cubic inch, or 0·000,000,002 cubic inches. A molecule of hydrogen is supposed to contain two atoms, so that the volume of the hydrogen atom would be one billionth of a cubic inch, and its weight, one hundred and thirteen thousand three hundred and sixteen nonillionths of a grain, or 0·000,000,000,000,000,000,000,000,113,316, of a grain. Accepting this result, the weights of the atoms of other elements can be found by multiplying the weight of the hydrogen atom by the atomic weight of the given element. The reader who desires to learn more, in regard to the measurement of molecules and atoms, will find the subject clearly treated in "The New Chemistry," by Professor J. P. Cooke.

Now it is supposed that the amount of heat, required to raise the temperature of an atom through a given range, is the same, whatever the nature of the atom may be; and hence, as the weights of atoms of different substances vary greatly, the amounts of heat necessary to increase the temperatures of given weights of different substances must also vary. It has not been proved by experiment that the amounts of heat do vary precisely in accordance with the atomic weights of different substances; but the agreement is sufficiently close to justify the presentation of the theory as a plausible explanation. The amount of heat, expressed in British thermal units, required to raise the temperature of one pound of a substance one degree on Fahrenheit's scale, for various elementary and compound substances, will be found in the accompanying table. These numbers represent the specific heats of the different substances, and are generally the values as determined by Regnault. The specific heat of a substance varies with the temperature, and the values given in the table are those for ordinary temperatures. In the case of gases, they are supposed to be in such a condition as to conform sensibly to the laws affecting perfect gases.

If the specific heat of an alloy at ordinary temperatures is required, it may be found, with sufficient accuracy for most purposes, by the following rule:

Multiply the specific heat of each metal in the alloy by the percentage of weight of that metal, add the several products, and divide by 100.

Example: What is the specific heat of an alloy containing, by weight, 46·73 per cent of lead, and 53·27 per cent of tin?

| | |
|---|---|
| Answer: Specific heat of lead | 0·03065 |
| Multiply by | 46·73 |
| | 1·432 |
| Specific heat of tin | 0·05623 |
| Multiply by | 53·27 |
| | 2·996 |
| Add | 1·432 |
| Divide by 100 | 4·428 |
| Specific heat of alloy | 0·04506 |

The specific heat of water given in the table is for water at or near the temperature of maximum density. To find the specific heat at any other temperature:

Subtract 39·2 from the given temperature, square the difference, multiply it by three hundred and nine billionths, and add the product to unity.

Example: What is the specific heat of water at 90° Fah.?

| | |
|---|---|
| Given temperature | 90·0 |
| Subtract | 39·2 |
| | 50·8 |
| Square of 50.8 | 2580·64 |
| Multiply by | 0·000000309 |
| | 0·001006 |
| Add | 1·000000 |

Specific heat of water at 90° Fah. 1·001006

With these explanations, the table will probably be found sufficiently complete for general practice.

TABLE OF SPECIFIC HEATS, SHOWING THE NUMBER OF UNITS OF HEAT REQUIRED TO RAISE THE TEMPERATURE OF ONE POUND OF A SUBSTANCE ONE DEGREE FAHRENHEIT.

| | | | |
|---|---|---|---|
| Air | 0·23740 | Chloride of strontium | 0·11990 |
| Alcohol (liquid) | 0·61500 | " " zinc | 0·13618 |
| " (vapor) | 0·45340 | Chlorine (gas) | 0·12100 |
| Aluminium | 0·21430 | Chromium | 0·12000 |
| Ammonia (vapor) | 0·50830 | Cobalt | 0·10730 |
| Anthracite coal | 0·20100 | Copper | 0·09515 |
| Antimony | 0·05077 | Corrosive sublimate | 0·06889 |
| Aragonite | 0·20850 | Corundum | 0·19762 |
| Arsenic | 0·08140 | Diamond | 0·14687 |
| Benzine | 0·45000 | Ether (liquid) | 0·50342 |
| Bismuth (solid) | 0·03084 | " (vapor) | 0·48100 |
| " (liquid) | 0·03630 | Galena | 0·05088 |
| Bituminous coal | 0·20085 | Glass | 0·19766 |
| Boron | 0·25000 | Glucinum | 0·23080 |
| Brass | 0·09391 | Gold | 0·03244 |
| Bromine (liquid) | 0·10700 | Graphite | 0·20083 |
| " (gas) | 0·05550 | Hydrochloric acid | 0·18450 |
| Cadmium | 0·05669 | Hydrogen | 3·40900 |
| Carbonic acid | 0·21630 | Ice | 0·47400 |
| " oxide | 0·24500 | Iceland spar | 0·20858 |
| Chalk | 0·21485 | Iridium | 0·05700 |
| Charcoal | 0·24150 | Iodide of mercury | 0·04197 |
| Chloride of barium | 0·89570 | " " potassium | 0·08191 |
| " " calcium | 0·16420 | " " silver | 0·06159 |
| " " lead | 0·06641 | Iodine (solid) | 0·05412 |
| " " magnesium | 0·19460 | " (liquid) | 0·10822 |
| " " manganese | 0·14250 | Iridium | 0·03259 |
| Iron | 0·11380 | Rhodium | 0·05803 |
| Iron pyrites | 0·13001 | Ruthenium | 0·06110 |
| Lead (solid) | 0·03065 | Salt | 0·17295 |
| " (liquid) | 0·04020 | Sapphire | 0·21737 |
| Lithium | 0·94080 | Selenium | 0·07446 |
| Magnesium | 0·24990 | Silica | 0·19132 |
| Manganese | 0·12170 | Silicon | 0·17740 |
| Marble | 0·20989 | Silver | 0·05701 |
| Mercury (liquid) | 0·03332 | Sodium | 0·29346 |
| " (solid) | 0·03192 | Steam | 0·48050 |
| Molybdenum | 0·07218 | Steel | 0·11750 |
| Nickel | 0·11080 | Sulphide of carbon | 0·15706 |
| Niobium | 0·06820 | " " zinc | 0·12813 |
| Nitrate of sodium | 0·27821 | Sulphur (native) | 0·17760 |
| " " silver | 0·14352 | " (purified) | 0·20259 |
| Niter | 0·23875 | " (liquid) | 0·23400 |
| Nitric oxide | 0·23150 | Sulphuric acid | 0·34300 |
| Nitrogen | 0·24380 | Tantalum | 0·04840 |
| Nitrous oxide | 0·22380 | Tellurium | 0·04737 |
| Oil of turpentine (liq'd) | 0·46727 | Thallium | 0·03355 |
| " " " (vapor) | 0·50610 | Thorinum | 0·05800 |
| Olefiant gas | 0·40400 | Tin (solid) | 0·05623 |
| Olive oil | 0·31000 | " (liquid) | 0·06370 |
| Osmium | 0·03113 | Tungsten | 0·03342 |
| Oxygen | 0·21750 | Uranium | 0·06190 |
| Palladium | 0·05928 | Vanadium | 0·08140 |
| Petroleum | 0·46840 | Water | 1·00000 |
| Phosphorus | 0·18870 | Wood spirit | 0·64500 |
| Platinum | 0·03243 | Zinc | 0·09555 |
| Potassium | 0·16956 | | |

### Cast Iron—Interesting Investigations.

The fact that solid plates of cast iron may be made to float upon molten iron has been explained by the hypothesis that molten iron was denser than solid iron. At a recent meeting of the Royal Society, Mr. Robert Mallet read a paper, the object of which was to show that the evidence is insufficient, and that, with respect to cast iron and to the basic silicates constituting iron slags, the allegation of their expansion in volume, and therefore their greater density when molten than when solid, is wholly erroneous. The determination of the specific gravity in the liquid state of a body having so high a fusing temperature as cast iron is attended with many difficulties. By an indirect method, however, and operating upon a sufficiently large scale, the author has been enabled to make the determination with considerable accuracy. A conical vessel of wrought iron of about 2 feet in depth and 1·5 feet diameter of base, and with an open neck of 6 inches in diameter, being formed, was weighed accurately, empty and also when filled with water level to the brim; the weight of its contents in water, reduced to the specific gravity of distilled water at 60° Fah., was thus obtained. The vessel being dried was now filled to the brim with molten gray cast iron, additions of molten metal being made to maintain the vessel full until it had attained its maximum temperature (yellow heat in daylight) and maximum capacity. The vessel and its contents of cast iron, when cold, were weighed again, and thus the weight of the cast iron obtained. The capacity of the vessel when at a maximum was calculated by applying to its dimensions at 60° the expansion calculated from the coefficient of linear dilatation, as given by Laplace and others, and from its range of increased temperature; and the weight of distilled water held by the vessel thus expanded was calculated from the weight of its contents when the vessel and water were at 60° Fah., after applying some small corrections.

We have now the elements necessary for determining the specific gravity of the cast iron which filled the vessel when in the molten state, having the absolute weights of equal volumes of distilled water at 60° and of molten iron. The mean specific gravity of the cast iron which filled the vessel was then determined by the usual methods. The final result is that, whereas the specific gravity of the cast iron when cold was 7·170, it was only 6·650 when in the molten condition; cast iron, therefore, is less dense in the molten than in the solid state. Nor does it expand in volume at the instant of consolidation, as was conclusively proved by another experiment. Two similar 10 inch spherical shells, 1·5 inches in thickness, were heated to nearly the same high temperature in an oven, one being permitted to cool empty as a measure of any permanent dilatation which both might sustain by mere heating and cooling again, a fact well known to occur. The other shell, at a bright red heat, was filled with molten cast iron and permitted to cool, its dimensions being taken by accurate instruments at intervals of thirty minutes, until it had returned to the temperature of the atmosphere (53° Fah.), when, after applying various corrections, rendered necessary by the somewhat complicated conditions of a spherical mass of cast iron losing heat from its exterior, it was found that the dimensions of the shell whose interior surface was in perfect contact with that of the solid ball which filled it were, within the limit of experimental errors, those of the empty shell when that also was cold (53° Fah.), the proof being conclusive that no expansion in volume of the contents of the shell had taken place.

It is a fact, notwithstanding what precedes, and is well known to ironfounders, that certain pieces of cold cast iron do float on molten cast iron of the same quality, though they cannot do so through their buoyancy. As various sorts of cast iron vary in specific gravity at 60° Fah., from nearly 7·700 down to 6·300, and vary also in dilatability, some cast irons may thus float or sink in molten cast iron of different qualities from themselves through buoyancy or negative buoyancy alone; but where the cold cast iron floats upon molten cast iron of less specific gravity than itself, the author shows that some other force, the nature of which yet remains to be investigated, keeps it floating; this the author has provisionally called the repellent force, and has shown that its amount is, *cæteris paribus*, dependent upon the relation that subsists between the volume and "effective" surface of the floating piece. By "effective" surface is meant

all such part of the immersed solid as is in a horizontal plane, or can be reduced to one. The repellent force has also relations to the difference in temperature between the solid and the molten metal on which it floats. The author then extends his experiments to lead and solidified iron furnace slag, with analogous results.

WHY SOLID IRON FLOATS IN MOLTEN IRON.

Two explanations, says Dr. Vander Weyde, are given of the floating of solid iron in molten iron. The first is that the iron expands in solidifying, as water does, and that therefore solid iron when heated is specifically lighter than liquid iron, and floats upon it as ice floats upon water. This supposition, however, is incorrect, inasmuch as it is based upon an erroneous assumption. Iron does not expand in solidifying, a fact of which any one may convince himself by brief observation in a foundery. The fact is just the reverse; the metal shrinks during solidification, after having been cast in a mold. By casting, for instance, a long piece in a vertical mold, the solidified piece will not fill the mold to the top, as did the liquid iron. The explanation given by Dr. Van der Weyde himself is that the iron is surrounded by a film of air adhering to it, which repels the molten iron and prevents contact; on which account the solid piece displaces more liquid metal than its own weight amounts to, and consequently it floats.

## PRACTICAL MECHANISM.

NUMBER VII.

BY JOSHUA ROSE.

### VISE WORK—TOOLS.

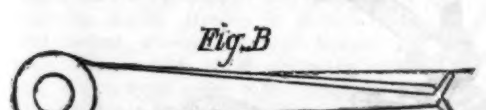
The tools used by the vise hand being nearly all supplied to him ready made, but few remarks need to be made to him upon the subject of their form.

CALLIPERS.

Outside callipers, that is, those used for measuring external diameters, should have larger rivets in them than they are generally given, a fair proportion being a rivet of one half inch diameter for a pair of callipers intended to measure up to diameters of seven inches. The points of such callipers should be tapered to a wedge shape, the tapering face being on the outside edge, so that the same part of the points of each leg will touch the work, whether the latter is of small or large diameter; the points where they meet together should be slightly rounding, so that they will touch the work at the middle of each point.

Fig. A represents an excellent proportion and shape for outside callipers. For use on threads, the points must either be made very broad, and come together level and even so as to gage the tops of the thread, or be made very thin, to gage the bottom of the thread. The proper shape for inside callipers is that given in Fig. B. The points and legs being made of the form here represented enables the callipers to have a large rivet and washer, and to enter a smaller hole, and clear a longer distance, than is possible where the points are bent round in the manner commonly employed. The dotted lines denote the distance the callipers would clear when in the position shown.

Fig. B



Another feature to the advantage of this form is that, when the legs are extended, the points are still at the extreme end of the callipers, so that the points will measure to the extreme end of the hole, even though the latter is closed by metal, that is, terminates in the metal. This is not the case when the calliper ends are bent round to the usual extent, for the curve of the bend will touch the end of the hole and prevent the calliper points from reaching it. In measuring with callipers, let the points be set to touch the work very lightly indeed, or they will spring from the pressure due to forcing them over the work.

Compass callipers, such as illustrated by Fig. C, are

Fig. C.

valuable tools. When opened in the manner here shown, they may be employed to mark off the centers of holes or to try if a center already existing is in the exact center of the hole. Or they will mark off a face, so that it will fit another face, whether it be regular or irregular, the curved point being kept against the irregular face, and the point describing (by moving the compass along) a similar line on the face to be fitted. They will answer for many of the uses to which a scribing block is put; and being lighter and more easily handled, and, furthermore, capable of doing duty without the use of a surface or scribing plate, they are in such cases far preferable.

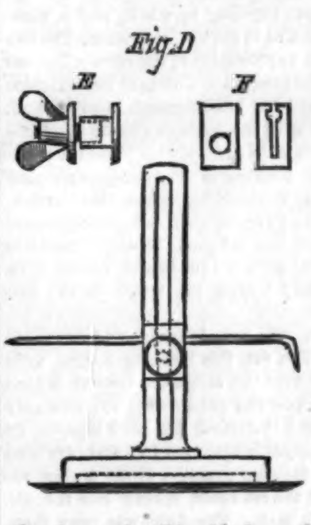
The legs may be crossed so that the curved point inclines to the straight point, in which position they will mark the centers of shafts or rods, either round, square, or any other shape, or try such centers, when they already exist, more accurately than can be done by any other tool. They will, in this case, mark off a line at the distance to which they are set, round any surface; they are employed to mark off keyways, or the taper of a gib when the key and one edge of the gib is placed, and for a variety of other uses too numerous to recapitulate, being among the most useful tools the fitter can possibly possess. The points of callipers should be tempered to a blue, and of compass callipers to a straw color.

THE SQUARE.

The square is too common a tool to require any description of its form. The best method to make one is to make the back of steel, and in two halves, one half being the thickness of the blade thicker than the other. The slot for the blade must then be filed in the thickest half, to the depth exactly equal to the thickness of the blade. The two halves composing the back must then be riveted together, and the edges surfaced each true of itself (using a surface plate to try them), and also true with each other. The blade, which should be made of saw blade, may then be put into its place, ready to have the holes for the rivets drilled. It should be placed so that the outer end is a little depressed (on the inside angle) from the right angle; this is done so that whatever there may be to take off the blade (after it is riveted to the back), to make its edges form right angles to the back, will require to be taken off the outer end of the inside angle and the end of the blade forming the corner of the outside angle, so that no work will require performing on the blade in the corner, formed by the blade entering the back on the inside angle, where it would be difficult to file or scrape without injuring the edge surface of the back. The best way to true a square is to turn up a piece of round iron equal in length to the square blade, being careful to make it quite parallel, and then true up the end of the iron, making it hollow towards the center, or cutting it away from the center to within an eighth of an inch of its diameter, so that it will stand steadily on its end. If the piece of iron be then stood on its end on a surface plate, its outline on each side, which represents its diameter, will form a true right angle to the surface of the plate, and hence a gage with which to true the square.

THE SCRIBING BLOCK.

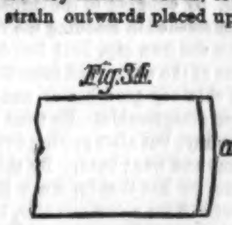
This tool is made in a variety of forms, but the simplest and best form is that shown in Figs. D, E, and F. Fig. D is the block complete, the scriber being a simple piece of round steel wire. The dotted line on the foot is the distance to which the foot is hollowed out to make it stand firm. Fig. E is the bolt and nut; the bolt has a flat side filed on each side of it to fit it to the slot in the scribing block stem, so that the bolt cannot turn when it is being tightened. Fig. F is a face and edge view of the piece or clamp for the scriber which passes through the hole in the slot.



The advantages possessed by this form over other forms of scribing block are that it is easy to make, and that the scriber, being a piece of wire, is easily renewed. It holds the scriber very firmly indeed, and the scriber may be moved back and forth without the nut becoming slack, an object of great importance not attainable in the common form of this tool.

CHIPPING.

The chisel requires special notice, since it is frequently made of the most ill-advised shape (for either cutting smoothly or standing the effects of the blow), that is, hollow, as in Fig. 33, in which case there are two sections of metal, represented by the dotted lines, *a a*, which are very liable to break, from their weakness and from the strain outwards placed upon



them by the cut, which, acting as a wedge, endeavors at each blow to drive them outwards instead of inwards, as would be the case in a properly shaped chisel, as shown in Fig. 34, *a* being the cutting edge.

When using, hold it firmly against the cut, and it will do its work smoother and quicker.

The cape, or, as it is sometimes called, cross-cut chisel, is employed to cut furrows across the work to be chipped, which furrows, being cut at a distance from each other less in width than the breadth of the flat chisel, relieve the flat chisel and prevent its corners from "digging in" and breaking. If a large body of metal requires to be chipped off cast iron or brass, the use of the cape chisel becomes especially advantageous, for the metal, being weakened by the furrows, will break away in pieces from the force of the blow, without requiring to be positively cut by the chisel; but care must be taken to leave sufficient metal to take a clean finishing cut, for when the metal is broken away, by the force of the blow, it is apt to break out below the level of the cut. It is also necessary to nick deeply with a chisel the outside edges of the work at the line representing the depth of the metal to be chipped off, so that the metal shall not break away at the edges deeper than the cut is intended to be.

FILING.

Large files should be fitted to their handles by making the tine of the file a low red heat and forcing it into the handle, so that it will burn its way into the handle, and thus prevent the handle from splitting, as it would do if the file tine were driven in; the file and handle should be turned in the hands occasionally to guide the eye in detecting whether the file is entering in a line with the length of the handle. Care should be taken to wrap a piece of waste around the end of the file, and to keep it wetted with water so as to avoid softening the teeth of the file while heating the tine. For small files, it is sufficient to bore a small hole in the handle and force the tine in by hand. A file should be held so that the butt end of the file handle presses against the center of the palm of the hand, the forefinger being beneath the body of the file handle.

In selecting a file, choose one that is thickest in the center of its length, and of an evenly curved sweep from end to end, so as not to make the surface of the work round by filing away the edges. Files that have warped in the hardening may be used on very narrow surfaces, or on round or oval work; or, if they are smooth files, they may be used on lathe work. Keyways or slots, especially, require an evenly rounded file; and if the keyway is long and the file parallel or uneven upon its surface, the end of the file only should be used to ease away the center of the keyway or the high spots. It is also highly advantageous to rub chalk on the teeth of the file, so that, after a little using, the eye can detect the part of the file which is highest, and govern its use accordingly.

Half round files should be rounded lengthwise of the half round side of the file, because it is difficult to file out a sweep evenly, even with a well shaped file, and it is impossible to do so with a file whose half round surface is hollow in the direction of its length.

These files must be used with a side sweep, caused by gradually bending the wrist at every stroke of the file, so that the file marks are not at a right angle to the curve, the sweep of the file being varied occasionally from right to left or from left to right, so that the file marks cross one another, otherwise there will be high ridges or waves in the curve.

In draw filing, be careful to note the higher parts of the file and use them only for flat surfaces, also to clean the filings out occasionally to prevent scratches in the work, and to rub chalk upon the file, which will prevent the filings from getting locked in the teeth; then, after every few strokes of the file, brush the hand over it to loosen the chalk and filings, and strike it lightly against the screw box or other soft part of the vise, which is more expeditious than, and equally as effective as, using the file card every time; when, however, the file requires chalking again, which will easily become apparent, the file card may be advantageously applied before applying the chalk.

Rough or bastard files are used to take off metal in quantity; but if the surface of the work is unusually hard, a second cut file will better answer the purpose. For finishing work very finely, cross file it with a smooth file and then draw file it with the same; then cross file it with a dead smooth file, and draw file it with the same, using very short strokes of the file and applying chalk to it.

A worn dead smooth will finish finer than a new one, and better results will be obtained by finishing the work crosswise of the grain than in a line with it, because any inequality in the texture of the metal will usually run with the grain, and the file teeth will cut the softer parts more readily when following in their length than when merely crossing them.

EMERY PAPER.

In applying the emery paper, use at first No. 1 paper both along and across the work, and repeat the process with No. 0, No. 00, No. 000, or No. 0000, according to the fineness of the polish required, bearing in mind that, the more the emery cloth or paper has been used, the finer is the polish it will give, the reason being that it becomes coated with a glazed surface, composed of particles of the metal it has been rubbing; and all metals polish finer and brighter with such a surface than with any other. If the finer grades of emery cloth or paper cannot be readily obtained, take the finest grade at hand, and wear it down by using it on a rod or piece of metal in a lathe at a high speed, wiping the rod once during the latter part of the operation with a piece of rag or waste slightly oiled, which will cause the oil to pass to the emery paper, and the latter to retain the particles of metal upon its surface. If this method of polishing be carefully executed, the work may be kept very true and even, and possess a finer finish and polish than by applying oil stone or by any other known method.

Before commencing any piece of work, measure it all over; and if it has a rectangular part, apply the square to it so as to be assured, before any work has been done to it, that it will clean up to the required dimensions.

MANUFACTURE OF LAMP BLACK.—J. H. Bottenberg, Ravenna, O., provides a revolving cylinder, which is kept cool. Within is a series of gas jets, which deposit carbon on the interior of the cylinder, which carbon is removed by scrapers by the turning of the cylinder.

THE BLACKSTONE AND ELMER WATER WHEEL.

The principal advantages claimed for the improved water wheel, represented in our illustrations, consist in the utilization of the full force of the water, the construction which prevents breakage of the wheel through the entrance of obstructions, the relation of the size of the chutes to that of the issues, so that the water leaves the wheel with the same velocity with which the latter runs, and the arrangement of the buckets to reduce friction to a minimum. Other points of merit will be noted in the course of the description.

Fig. 1 is a perspective view. Fig. 2 shows the apparatus in section, and Fig. 3 the wheel separate from its attachments.

At A are the buckets, B the chutes, and C the gates. D, Figs. 2 and 3, is a horizontal extension of the top of the wheel hub, which is calculated to receive a lifting action of the water entering below, and will largely counteract the downward pressure of the water on the buckets. The projection of the rim of the wheel prevents the water rising up over the extension so as to neutralize the lifting action. The buckets, as shown in Fig. 3, are made to terminate above at the bottom of the chutes, with the exception of narrow extensions left for their more permanent connection with the hub. By this means a clear annular chamber, E, Fig. 2, is formed in front of the chutes, into which the water flows in solid volume, and in better condition for entering the buckets than were it broken by the action of the latter revolving immediately against the chutes.

The construction of the chutes is such that they are tangent to the rim of the wheel or very nearly so; thus, it is claimed, allowing of the employment of the full force of the water instead of only a component of the same. The buckets are made with a radial termination, *a*, and have dimensions between the lines, *a b*, decreasing from the rim of the wheel to the hub, as the radii of circles from the rim to the hub decrease. The curve of the bucket, in brief, is the curve of the quickest descent for a body acted upon by gravity.

The gates, C, which close the mouths of the chutes, are hollowed out on the inner side, leaving only a bearing surface around the edge. They are provided with stems which pass through the gate operating frame, F, and have ample play on their seats. The exterior water pressure holds the gates firmly against the chutes; but should an obstacle be carried into an aperture, the gate thereon will yield, swinging partially open and will not be broken. While the gates are entirely independent of each other, all are operated to open or shut at once, unless one or more be obstructed, in which case it, or they, alone will remain open.

Fig. 2.

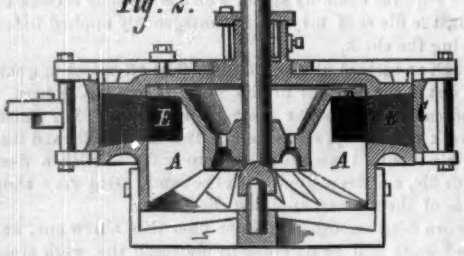
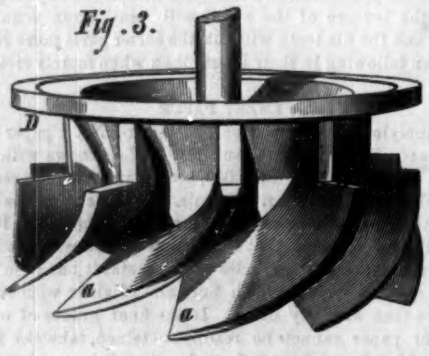


Fig. 3.



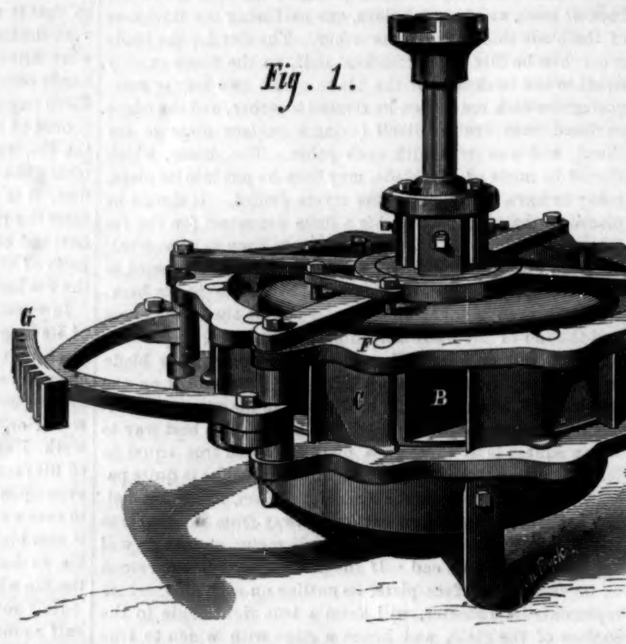
The rack and pinion, G, for governing the gates, are placed at a distance from the wheel, to avoid wearing or clogging by sand and *débris*, and also that the gate rod may not come in contact with any of the pulleys or gears that may be on the wheel shaft. These arrangements do not have to be removed in case a wheel is taken up. The spider is placed on the outside of the case, thus preventing the wheel from being broken in case the step should chance to wear down.

Two wheels are made for each size, No. 1, it is claimed, utilizing ninety per cent of the effect of the passing water, and No. 2, eighty-six per cent.

The patents under which the device is constructed are dated April 8, 1873, and March 24, 1874. For further particulars, address the manufacturer, Mr. C. C. Paige, Eagle Iron Works, Oshkosh, Wis.

SCIENCE is the trunk of a mighty tree, the roots of which penetrate into the unknown, and the branches flourish in the useful arts.

Fig. 1.



THE BLACKSTONE AND ELMER WATER WHEEL.

**Rat Science vs. Alligator Strength.**

"A wholesale drug store on Magazine street is the happy possessor of a young and domesticated alligator. This little crocodile has become quite the pet and plaything of the establishment; he is of an amiable disposition, fond of music and dinner, and quite submissive, shedding tears and showing repentance whenever it is found necessary to correct him. It was resolved by the clerks in the establishment—as the alligator had reached his third birthday and increased to three feet in length—to utilize him, to put him to some other employment than that of a mere pet. It was concluded to make use of Crocky, the alligator, as a cat, and it is well known that alligators have a special and inestimable hatred toward rats. A rat to practice on was caught the other day.

Rat and alligator were put together in a box, and a numerous audience crowded around to get the front place. The two enemies soon awoke to an appreciation of the case. The rat safely and snugly ensconced himself in a corner. The alligator hesitated a second, scratched his head (metaphorically), and, having made up his mind as to the mode of attack, advanced slowly towards the rat with wide open jaws. The rat trembled; there was no escape, nothing but the wide open mouth of the alligator before him. Without hesitation, like Curtius, he jumped straight into the yawning gulf, and, getting a good hold on the lower lip of the alligator, swung himself to the ground. The 'saurian' gave a squeak and swung himself around, the rat finally letting go, victor in the first round.

The alligator, however, was not daunted, and advanced with the same tactics. The rat this time, by a most agile movement, leaped entirely over the alligator. Getting behind him, he now proceeded to chaw and gnaw away. The unwieldy animal could not get around to defend his hind legs. By a good use of his tail, the alligator again got free and advanced desperately, though with flagging courage, at the daring rodent. With equal success the rat again sprang into the air, alighting on the alligator's back. The fight was over then. The alligator could not shake his enemy off, could not dislodge him; and finally gave up the fight, laying himself down on his belly in a submissive attitude. The rat was set at liberty and given the run of all the drugs and medicines, while the poor alligator was doomed to disgrace and ridicule."

**A Squirrel's Leap.**

Recently, says the *Bangor* (Me.) *Whig*, a little red squirrel, having been pestered considerably by the lads above the saw mill of Eben Webster & Co., on Marsh Point, Orono, took refuge for life by running up the large brick chimney near the mill. By clinging to the corner, he kept foothold so well that he succeeded in reaching the very top. Here he found himself upon the iron cap, 105½ feet from the ground. As more and more of the waste stuff from the mill was added to the furnace, the chimney grew hotter and his situation became more and more disagreeable. He tried to descend upon the side of the chimney, but after getting down a few feet gave it up, turned about and went back. By this time the chimney top had become so hot that he must leave it; so after looking about carefully for a few minutes, he evidently made up his mind that he must leap to save his life, and this he did, spreading out his legs and balancing himself so that he struck the ground about fifty feet from the base, uninjured, and immediately scampered off and secreted himself under a pile of boards a little distance away.

**Dangers of Elm Trees.**

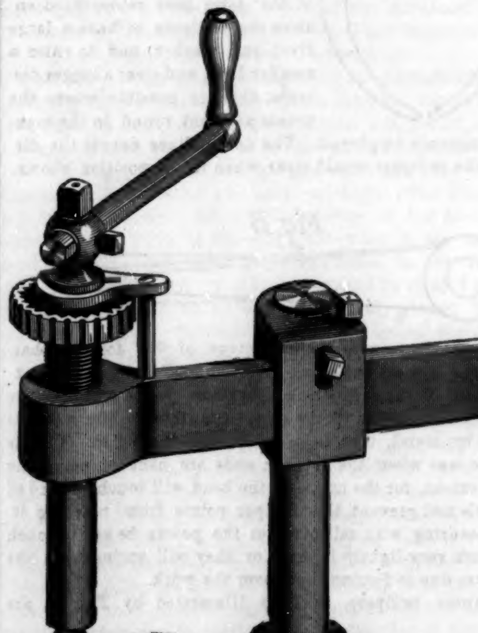
It is a character of some trees, of the species of elm in particular, to drop large branches during the hot months, without any external warning beyond, perhaps, a preliminary crack or two. An accident of this nature lately occurred in Kensington Gardens, London, when an immense branch, about twenty yards long, fell with a crash like thunder, and more than a score of children had a narrow escape for their lives. Three, who were sitting below the bough, alarmed by the second crack, ran away, and thus saved themselves from almost certain death. The branches that thus suddenly snap are as verdurous as any of the others, and there seems to be no other defence than to avoid "the elm tree's shade" as much as possible. It was from just such an accident that the Queen was saved by the promptitude of her attendant; and there have been several very narrow escapes recorded, from a similar danger.

IMPROVED HAND CRANK DRILL.

Many a superintendent or foreman of a shop has, doubtless, wondered at the extreme slowness with which his hand drills penetrate metal when operated by certain workmen. The metal does not appear unusually hard, the tool seems in excellent order, and the man even, when the boss is at the other end of the shop, turns away at the handle with exemplary rapidity, and yet the hole is an astonishingly long time in getting through. The trouble lies in the simple fact that while it is a very easy matter to keep turning a drill around and around in the same hole, it takes considerably more labor to rotate the instrument and, at the same time, force it down into the metal. This truth once through the cranium of a lazy workman, he utilizes it to his advantage, by neglecting to screw down his feed whenever the foreman's back is turned. Further explanation as to why the hole progresses slowly is unnecessary, but we may, instead, proceed to describe an invention which is excellently calculated to disgust lazy individuals who practice such systems of shirking.

The device, as represented in the annexed engraving, is a patent crank drill which is provided with an automatic feed, that is, whenever the handle is turned, feeding must take place. At the upper extremity of the feed screw is a horizontal hollow wheel, the inner periphery of which is suitably notched. On the drill spindle which passes down through the screw is an eccentric block, not shown in the engraving. This is so arranged that at each turn of the handle a projection, to which it imparts a to-and-fro motion, enters a notch in the wheel and carries the latter and, consequently, the screw around for a certain distance, thus feeding the drill downward. It is impossible to rotate the handle without causing the above described action, and hence a continuous and regular feed is kept up, independent of the workman.

The remainder of the apparatus is readily understood from the engraving. It is constructed entirely of cast steel, with the exception of the handle and the castings to receive the standard. Two of these castings are furnished, one with its foot at right angles to the drill, the other parallel.



A change of spindle can be made almost instantly to suit drills of different shanks, and if desired a hand feed can be used. The arrangement for holding the standards is such that, with any reasonable degree of care, it will not be marred.

The instrument works easily and efficiently, and is, in general construction, a thorough and substantial tool. It is manufactured by the New York Steam Engine Company, of No. 98 Chambers street, New York city.

### BOUQUETS FROM FIELD AND GARDEN.

Our contemporary *The Garden*, in discussing the arrangement of bouquets, states that the excessive formality of the present orthodox form of presentation or ballroom bouquets exhibits a kind of close packing, in which the delicate graces of flower form are entirely submerged in consequence of this close, even tight, juxtaposition. The end sought in this kind of grouping appears to be a method of packing together (according to price) an abundance of rare and, consequently, expensive flowers, all of which must be got into the same lump. This system, of course, necessitates the use of such flowers as are more or less rare, and there is, perhaps, no other way of making up a bouquet that shall be fairly worth, in intrinsic value, from $1 to $25. The cut flowers of which the bouquet is composed are, probably, worth all the money, at their respective market prices; and for certain occasions, bouquets so manufactured may be deemed appropriate, even necessary; but as works of art they are utterly valueless. A few elegant grasses from the meadow, combined with a selection, at any season, of flowering branchlets from the shrubbery or common garden border, and a freehanded and tasteful grouping, without crowding, and with a well balanced proportion of natural foliage, may be made to form a composition such as a painter might desire to transfer to his canvas, while he assuredly could never wish to dip brush in color for one of the expensive bouquets of the cauliflower shape. Such has long been a favorite theory of the writer in the matter of flower grouping; and the other day he found it gracefully exemplified on the drawing room table of a friend, by a graceful half wild bouquet from field and garden, formed with the free grace and uncrowded arrangement which, as nearly as may be, illustrated his views. It is needless to state that a lady's fingers and a lady's taste were the joint authors of the composition. In the arrangement, each flower and grass of the gathering had been made to find its seemingly proper place, unjostled by its neighbor, and so freely and easily located in its basket work receptacle, supported on three slender canes of bamboo, that even its foliage had room to display its graces and modes of growth. With the permission of the lady flower grouper herself, a drawing was at once made, a reproduction of which, in the form of a careful wood engraving, and for which we are indebted to our valuable contemporary, will be found on this page.

The central object was a small spray of guelder rose, with two or three of its spherical masses of snowy flowers, surrounded and supported by their own leaves. There was also a rose, perhaps one of the first of the season in the garden where it was gathered; and there were some smaller Scotch roses, accompanied by sprays of their miniature foliage. There was also, it will be seen, a flower of white pink, with buds, and with leaves which have room to display their delicately slender forms and the pale glaucous hue of their dainty green. A common corn flag towered in the center; and on the left was a single iris, backed by its blade-like leaves. Grasses of several kinds shot upward, crowned by their feather-like inflorescence, which added a pleasing lightness and careless grace to the composition. The effect was hightened as regards color by two sprays, not more, of pelargonium flowers, gathered with their leaves, and by two or three kinds of fern, one gracefully weeping frond being allowed to droop negligently to the table, the slender extremity of which curled itself fantastically, as with a set declaration against primness, trimness, or any kind of slavish formality.

The value of grasses for arrangements of this kind is well shown in this case. Ferns themselves cannot show so airy a grace or such delicacy of form, Many graceful wild grasses may be gathered in the fields, and many beautiful hardy grasses are as easily grown in any cottage garden as the hardy flowers of which this charming bouquet was composed.

### Magnets.

M. Jamin describes experiments which support these three propositions: (1) The number of elementary magnetic threads, and so the quantity of magnetism a magnet may contain, depend only on the middle section. (2) The opening (*épanouissement*) of the poles of these threads, or the distribution of intensities, is regulated by the form and extent of the exterior surfaces of the magnet. (3) If the surfaces diminish, the tension increases till they become insufficient to allow of the elementary poles opening out, and a portion of the two contrary magnetisms disappears, reproducing the neutral state.

On combining 22 magnetized plates (each 0·04 inch long, 0·04 inch thick, and 2 inches broad) in a bundle, with pasteboard 0·032 inch thick between adjacent plates, each plate lost magnetism, and so the bundle, the loss of the latter being 50 per cent, which is less than in the case (first experimented on) of superposition without intervals; the loss was then 66 per cent. In this first mode all the magnetism retained was carried to the exterior; there was none, or almost none, between the plates. In the other mode the quantity remaining (151·1) was divided into two portions:—(1), 85·5, which was expanded on the exterior; and (2), 65·6, which remained in the intervals. With wider intervals the exterior magnetism is diminished, the interior increased; and gradually the plates act as if they were independent.

### Carbon in Cast Iron and Steel.

M. Boussingault contends that in cast iron, and in certain steels, the carbon is in two states—(1) combined with the iron and therefore invisible; (2) disseminated in the metal, either as an amorphous black powder or in brilliant crystaline laminæ, constituting the graphite of mineralogists. There is reason to believe that when cast iron is in fusion all the carbon is combined and is invisible, but that a portion becomes free on cooling. On acting upon a carburetted iron with acids, the state of the carbon is at once made known. The free carbon remains mixed with the insoluble residue. If no graphite is present, but merely combined carbon, there is no carbonaceous residue. The carbon is eliminated during solution, imparting a characteristic fetid odor to the hydrogen gas given off, due to volatile oily matters. This oily matter was

A JUNE BOUQUET OF GRASSES AND HARDY FLOWERS.

noticed by Proust in 1799. M. Chevreul remarked that in this case chemical forces give rise to compounds analogous to those formed by vegetable organisms. More recent researches have established that these compounds are not merely analogous but identical. The author does not believe that a steel exists absolutely free from carbon.

### Ex-Commissioner of Patents S. S. Fisher.

With the deepest regret we record the death, by drowning, on August 15, of Samuel S. Fisher, Esq., of Cincinnati, O, formerly Commissioner of Patents, the duties of which important post he performed with the most distinguished ability till the end of the year 1870, when he resigned. The accident which terminated this useful life was truly calamitous, as Mr. Fisher's son was drowned at the same time. They left Elmira, N. Y., on a summer boating excursion, intending to float down the Susquehanna to Havre de Grace, and enjoy the wonderful scenery which that river presents. The boat was unfortunately capsized in the Conewago Rapids, fourteen miles below Harrisburg.

The record of Commissioner Fisher will long survive him. His learning and practical good sense, accompanied by great force of character, gave him more than customary authority over the important department in which he presided, and enabled him to carry out many salutary reforms in the administration of the Patent Office. As a patent lawyer, he was widely renowned, and many of the most important litigations were entrusted to him, and some very heavy cases were in his office at the time of his death.

Commissioner Fisher served his country in the late war, as Colonel of an Ohio regiment, was President of the Board of Education in Cincinnati, and has filled many other important public positions.

RECENTLY, at New Haven, Conn., and vicinity, there was continuous rain for nearly forty hours, during which period eleven inches of water fell—one third of the annual fall.

### Sword Manufacture in Birmingham.

The manufacture of swords is one requiring great skill in all its departments. Success in this work depends upon the acquired skill, the long experience, the educated eye, and the manipulative power which seem to require many generations of workmen before they are attained in their higher excellence. The slightest mistake in working would make a sword blade useless, and this applies to each of the three great processes through which it has to pass—forging, tempering, and grinding. From the necessity of all the work being skilled work, each part of a sword—the blade, the grip, the hilt, the scabbard—is made by hand, and the witnessing of the manufacture is thereby rendered especially interesting. For the excellence of his swords, and for the skill displayed in every part of the work, no name in the history of the trade surpasses, and few if any rival, that of Mr. C. Reeves, of Birmingham, Eng., over whose works, with such efficient guides as Mr. Reeves and his son, says *Iron*, we shall now conduct our readers, in order that they may witness the making of a sword under the most favorable circumstances.

#### FORGING THE BLADE.

The first process is the forging of the blade. The steel comes from Sheffield in double molds, (the length of two blades), as it is called, and is the best steel, and is in strips, each strip being the length of two swords. The workman takes the strip and first breaks or cuts it across the middle. The handle end of the blade is of iron, as this metal bears more knocking about and can be used in a manner that would be fatal to steel. The iron end is then put in the fire, and the tang, or part to fit into the hilt, is forged. The blade is then passed through the fire a large number of times, and beaten out on the anvil in order to distribute the metal equally in every part. At the same time the furrow is worked up the center of the blade, wide or narrow according to the pattern and size required. In those known as Scotch blades two furrows are beaten. This is a work requiring great care and skill. The future worth of the blade depends upon the skill of the forger. The slightest defect or inequality in the distribution of the metal makes the blade to that extent imperfect. With a skillful workman this is, of course, of rare occurrence. He knows precisely the amount of hammering required. It may be noted here that every blade passes through the fire no fewer than twenty-five times before it is completely forged.

#### TEMPERING THE SWORD BLADES.

After forging follows the most delicate and important part in making a sword blade—tempering. On this process depends the perfection of the weapon, and it is quite pleasant to listen to Mr. Reeves while he descants on this part of the work. The object of tempering being, of course, to give the steel the required elasticity, it must not be too hard or it will break, and it must not be too soft or it will bend; but must be so equally tempered that, when its point is pressed on the ground, the blade will, when free, at once take its natural shape without hurt or detriment in the slightest degree. The mode by which this great, this necessary quality, is secured is as simple as it is effective. Before the blade can be tempered it must be made extremely hard; this is done by first passing it through the fire, and then, while hot, it is plunged into water. The first plunge hardens the blade to such an extreme hardness that it is as brittle as glass, and if thrown down would break into pieces. Again it is passed through the fire and then beaten straight, for the effect of the action of the water on the hot metal is to make it of all shapes. Just at the point at which the blade takes a particular color, known at once to the practiced eye, it is again plunged into the water which, in technical language, "prevents it going down lower," and is tempered. It can now be bent backwards and forwards without any fear of its breaking, and is ready for the grinder.

#### GRINDING THE SWORDS.

The grinding is done on the best Leeds stones, the blade being placed in a frame of wood, and its surface pressed on the stone until the work is done. This also depends upon the skill and the eye of the workman. In grinding the furrows, a stone of a peculiar construction is used. The face is cut into raised flutings of the size and shape of the furrows of different swords, and on these the blade is pressed, and the furrow effectually ground. This is called the hollowing stone. Each blade takes from an hour and a half to two or three hours grinding, according to its quality. We saw one blade ground, and also some matchets, a kind of scimitar knife used for cutting down sugar canes, etc, in India.

#### SWORD POLISHING.

The blade is now ready for polishing. This is done on lathes worked by steam. Different sized wheels are fitted on the spindle, and lard oil and double washed emery are used in the operation. The blade is often put into lime dust during the process; and on the lathe brush used, a crocus dust, of deep purple tint and ground very fine, is thrown over the brush, and a most brilliant polish is the result. Scab-

bards and hilts, and other ornamental parts of the sword, are also polished in much the same manner. In the case of scabbards, a larger wheel is used instead of the ordinary lathe brushes. When polished, the blade is ready for the hilt and scabbard; so we will now see how these are made. And first for the scabbard.

MAKING THE SWORD SCABBARDS.

In making a scabbard, the workman takes a piece of flat steel cut to the required size. He first places it on the top of an open vise, and beats it with a wedge-shaped wooden mallet, bringing the two edges closer together each time it passes along the vise. It is then beaten on both sides until they almost meet; a mandrel is then put down it, and the steel beaten close round the mandrel, both edges being hammered over. The edges are then soldered. It is next beaten on an anvil all round, the mandrel is withdrawn, and the scabbard is ready for the drag, which is a piece of iron fitted to, and fastened on, the bottom of the scabbard. The bands are then put on, and the scabbard, after being filed and smoothed, is ready to be polished.

MAKING THE SWORD GRIPS.

The making of the grips is also a very interesting bit of work. These are the handles by which the sword is gripped, hence the name. A grip at first is a bit of walnut, oblong in shape, but narrower at the end than the top. The back, which is made of metal; is placed on it, and the wood is worked into the required shape by files. A large number of different shapes, sizes, and cutting powers are used in this work. When the top has been cut, the grip shaped, and the tenon for the ferrule made, it is then "balled." For this purpose it is fastened in a vise, a three-sided file cuts a deep indention at regular intervals, each division is rounded or balled by a file, and the indentions connected by slanting interstices cut by a handsaw. The grip is then drilled through in a lathe, for the purpose of receiving the tang. When this has been done, a piece of the skin of a dog fish, which has been a long time soaked in water, is cut off. Every bit of flesh on the inside of the skin is then carefully cut off, and a piece of pure skin is left. This is put round the grip, a piece of string or wire is fixed by a loop to a piece of steel fastened in the vise, and the workman binds the skin tightly round the grip by winding the string or wire round the space between each ball. It is then filed and the back fitted on again. In making a grip, it passes through the workman's hands no fewer than thirteen times.

DRESSING THE HILTS.

A hilt is at first a flat bit of metal of a peculiar shape, and may be cut to any pattern. A large number of these are used, which are all made to a regulation size. The pattern used is placed on the metal, which is then marked. They are then filed and cut by hand, beaten on blocks and knobs into the shape of the hand, and afterwards polished, and made ready to be fixed to the sword.

This is called mounting. In the cheaper swords, the blade is bought from one person, the hilt from another, the scabbard from a third, and so on. But in this manufactory every part is made in the works, and each piece is prepared to suit and fit the other parts, so that when fitted together the sword is firm and sound; and the parts never give way or become loose, as they do when stuck on to the tang of a blade without any reference to their weight or suitability for each other and the blade to which they are attached. In such cases the parts with little wear become loose and rickety, and depend only upon the small rivet at the top for their security. In ordinary swords the blades and hilts, after having been ground, filed, and polished, are taken into the mounting shop. There the tang is placed in the grip. The hilt is fastened on by passing a rivet into the top of the grip, and fastening it to the tang. The hilt is drawn over this rivet, which passes through a hole at the top. It is then filed and broken off at a short distance from the hilt. The rivet is then welted by being filed, and smoothed until it has the appearance of an ornamental knob, forming an integral part of the hilt. These swords are now complete. In the mounting of best work, great care and skill are required. In the mounting shop, a very ingenious tool is used, called a float. It is a long bit of steel, shaped almost like a tang, with a series of blades along its surface. The grip is worked to-and-fro on the float until it is cut to the exact size and shape of the tang on which it is to be fixed. Great skill is required in this delicate operation. In this mounting room the swords are proved. This is done by placing the point of the blade on the floor, and bending it backwards and forwards. After it has stood this test, it is subject to another. The workman strikes the blade strongly on a wooden block, both on the edge and back, and can tell by the ring whether it is of true and perfect quality. By these tests the slightest fault or flaw would be detected, for a very small fault, indeed, would cause the blade to break.

The scabbards are lined. In the ordinary sword, two thin strips of wood of the shape of the scabbard are placed on either side, and they must fit so accurately that neither in drawing nor in sheathing the sword must the slightest obstruction be perceptible. In the better swords, leather is used in lining.

In the mounting and ornamenting of swords, any amount of artistic work can be employed either on the blade, the hilt, or the scabbard. The rank of the officer is indicated in this manner, and naval swords are ornamented differently to military. The work put on presentation swords is often most elaborate and expensive.

A NEW PAVEMENT, by Charles Pennington, of London, consists of a bed of concrete covered with an elastic layer, such as tar and tan bark. On this layer the blocks of stone are set, the crevices being filled with concrete.

## A NEW SCIENTIFIC MUSEUM.

Operations have begun for the erection of the Peabody Museum in New Haven, which, when completed, will contain some of the largest and richest zöological, geological, and mineralogical collections in the world. The institution is founded under a bequest of $150,000 from the late George Peabody, and is designed to bear the same relation to Yale College as the present Museum of Comparative Zöology does to Harvard.

The building will consist of a central edifice and two wings. For the present, only one of the latter is to be erected, with a frontage of 115 feet on one street and 100 feet on another. It will cost $160,000, be built of brick with stone trimmings, fireproof, and contain, including basement, four available stories.

The fourth story is assigned to archæology and ethnology, the third to zöology, the second to geology, the first to lecture rooms and mineralogical collections, and the basement to working apartments and a large class of heavy specimens, showing fossils, foot prints, etc.

## The Brazilian Telegraph.

The great ocean cable between Lisbon, Portugal, *viâ* the Azores, and Rio Janeiro, Brazil, is now complete and open for business. The charges from New York to Rio Janeiro are about $2.50 per word. The message goes *viâ* England, and through some eight thousand miles of submerged cables. Complimentary messages have been exchanged between President Grant, the Emperor of Brazil, the President of the Argentine Republic, and the President of Uruguay.

Last year the section of the above cable between Lisbon and Madeira was broken, and so remained until the present summer, when the two ends were fished up, joined, and relaid. The depth of water at the place of fracture was 2,500 fathoms, or about 2¾ miles deep, and the successful finding, raising, and joining of the broken ends at sea, shows the great perfection of mechanism and skill that has been acquired in ocean telegraph engineering.

## Fast Trotting.

At the Buffalo, N. Y., races, August 7, the famous horse "Goldsmith Maid" trotted the mile in 2m. 15¼s. After the race, the Maid was stripped and led in front of the judges' stand, when the immense crowd arose and greeted her with deafening cheers. Her driver, Budd Doble, was ordered on the judges' stand, where he received a becoming ovation. In 1867, the racer "Ethan Allen" trotted a mile in 2m. 15s. But both these performances were surpassed by one of "Goldsmith Maid's" three one mile heats at Rochester, N.Y., on August 12, which was trotted in 2m. 14¾s.

Running horses make much quicker time than trotters. In 1850, the English horse "Black Doctor" is reported to have run the mile in 1m. 40s.

## The Chassepot as Altered.

Two years ago, the French government decided to adopt the metallic cartridge in its military equipments, and an official commission was appointed to ascertain the best plan for altering the Chassepot rifles, one million or more in number, so as to receive the new ammunition. The commission has just decided to adopt the plan of alteration proposed by M. Gras, Captain of Artillery. The altered Chassepots will have a range of from one and a half to two miles. At a range of one and a half miles, the bullet has force enough to flatten against an iron plate. The accuracy of fire is very satisfactory.

## The August Meteoric Shower.

In the vicinity of New York, clouds obscured the heavens on the evening of August 10, and few observations of meteors were made. But we learn from a correspondent at Martha's Vineyard, Mass., that, near Edgartown, many beautiful meteors were seen.

## DECISIONS OF THE COURTS.

### United States Circuit Court.---District of Massachusetts.

BOTTLE FASTENER.—PATENT OF H. W. PUTNAM, GRANTED MARCH 15, 1859 AND EXTENDED FOR SEVEN YEARS, FROM MARCH 15, 1873.—HENRY W. PUTNAM *vs.* EPHRAIM D. WEATHERBEE, *et al.*

[Heard at Portland, Me., July 16, 1874.]

Shepley, Judge:

In the view which I take of the first claim of this patent, which is "forming the fastener at the part that comes over the cork of a piece of wire of U form, with the ends returned and connected to the bottle, in order that the pressure on the cork or stopper may cause the fastener to hold more securely, as specified," considering it in connection with the specification in the patent, it is not necessary that the wire which forms the U should be returned upon itself in a direction directly the reverse of that in which it is before the turn; but it is a sufficient compliance with the first claim of that patent if the wire, instead of being returned in a reverse direction from that which it had before, is returned at right angles, or approximately so, so as to be connected with the wire which encircles the neck of the bottle in the manner specified in the patent. In the construction which I give to this first claim there can be no question that the defendant's contrivance is an infringement. The only question, therefore, for consideration is whether the first claim of this patent be or be not a valid claim, and that question is one of significance, principally in its relation to the Allender contrivance. The Allender contrivance was considered by the Commissioner of Patents when this patent was granted. The disclaimer of the patentee clearly has reference to a contrivance like the Allender contrivance; and, taking that into consideration, the Patent Office granted the patent. It has since been sustained by the adjudications of several of the federal courts, it has been in existence a long time, and it has been renewed by the Patent Office after the expiration of the original term. Under these circumstances I think this is a clear case, in which the patentee is entitled to the presumption, *prima facie*, which his patent gives, aided as it is by the long enjoyment and by the adjudications of the courts, and is entitled to protection by a preliminary injunction.

In the construction which I give of the claim, the only defence which could be maintained would be to destroy the validity of the plaintiff's patent; and I think, when the patent has been in existence so long, has been renewed after a contest, and has been adjudicated in favor of the patentee by the courts, he is entitled to the benefit of it until the adjudication of some tribunal shall decide that his patent is invalid.

This case is pending in the Massachusetts district, and when the court is in session there, the order for a preliminary injunction will be issued.

I do not express any opinion as to the question which has been presented in the hearing on this case as to the validity of the issue of this patent, with reference to the existence of the Allender contrivance; but, as I have before said, I think the position in which the patent stands entitles the patentee, upon well established principles, to the benefit of the legal presumption in his favor until that question is decided.

[*W. H. Clifford* and *Thomas H. Dodge*, for complainant.
*Benjamin F. Thurston*, for defendant.]

### United States Circuit Court, Southern District of Ohio.

PATENT BOILER FURNACE.—GIDEON BANTZ *vs.* JACOB ELSAS *et al.*

[In equity.—Before Swing, J.—Decided June, 1874.]

SWING, Judge.

The bill in this case alleges that the complainant was the original and first inventor of an "improvement in boiler furnaces for burning wet fuel," for which he received a patent, June 22, 1858; that he surrendered said letters patent February 6, 1872, and obtained new letters patent therefor, which were afterward extended for seven years from June 22, 1872.* The bill then prays that defendants may be compelled to account for and pay over the profits of the infringement, and may be enjoined from making, vending, or in anywise using the patented improvement.*

It is claimed, by respondents, that there is no infringement,* because the combustion chamber or reservoir of the complainant is one having a *cyma-reversa* bottom, with narrow throat, whereas the combustion chamber or reservoir of the respondents has not the *cyma-reversa* bottom, but has one which is flat and set inclined, and has a wide throat instead of a narrow one.*

I think, however, that the leading idea of the complainant is found in a combustion chamber or reservoir arranged in its relations with the fire chamber and boiler, for a particular purpose, rather than in the particular form of the back or throat of such chamber or reservoir.

Decree for complainant.

[*John E. Hatch* and *Fisher & Duncan*, for complainant.
*Jacob Schroder*, for defendants.]

### United States Circuit Court—District of Massachusetts.

PATENT TABLE TRAY.—LUCY A. DOHERTY, ADMINISTRATRIX, *vs.* JAMES G. HAYNES.

[In equity.—Before Clifford, Judge.—Decided May 29, 1874.]

CLIFFORD, Judge.

Letters patent were granted to Nathaniel Waterman, on May 12, 1868, for an invention consisting of an improved table tray or waiter, as fully describer in the specification, and the record shows that the original letters patent were subsequently surrendered and reissued, as alleged in the bill of complaint, and that the complainant is the sole owner of the described invention, as secured in the reissued patent on which the suit is founded.* Various defenses are set up in the answer, of which the following are the only ones which require to be noticed:

First. That the invention is not patentable.

Second. That the person named in the original patent, as the patentee, was not the original and first inventor of the improvement.

Third. That the reissued letters patent were fraudulently obtained in violation of the rights of the respondent, and that the patent as reissued "covers more that was contained" in the original patent.*

Decree for complainant.

[*A. A. Ranney*, for complainant.
*C. D. Wright*, for defendant.]

## NEW BOOKS AND PUBLICATIONS.

AN ILLUMINATED HISTORY OF THE WORLD.

We have lately received an educational novelty, which, after examination, we can recommend to the notice of teachers and students as a valuable and useful aid to study. It is a chart, handsomely mounted and printed in colors, and in dimensions twenty-two feet long by thirty inches wide. Its aim is to teach the history of the world, biblical, ancient, mediæval, and modern, ranging over the entire period of human knowledge, from 4004 B.C. to 1874 A.D., or 5,878 years of historic time. The plan adopted, which is a very ingenious one, is to represent the progress of time by a continuous black line, which is divided into centuries, decades, and years. Parallel with this are other lines, or streams, representing nations, and the division or flowing together of these indicates conquests, foundations of new States, and similar events. The arrangement of the map is such that the student sees at a glance exactly the condition of the world at any given date; and by the aid of colors, pictures, and similar helps, he is given an idea of the progress of arts, names and succession of rulers, and similar facts important to be remembered. We need not point out the obvious utility of this remarkable production, since it is well known that, while a person may readily master the history of one people, he frequently, in taking up that of another nation, is at a loss to connect contemporaneous events, and hence the various records remain detached in his mind, instead of uniting to form a single and detailed history of mankind. With the chart under review, such a difficulty need not be encountered, since the student, while at work upon the history of a single nation, need only glance at the map to be informed at once as to what the rest of the world was doing during the periods passed over. The execution of the work is excellent, and indicates an immense amount of labor and research on the part of the author, which should not go unrewarded. The length of the map necessitates its mounting upon rollers and arrangement in a neat frame, in which it is hung against the wall so as not to occupy more than three feet of space, suitable cranks on the ends of the rollers allowing the chart to be unwound like a panorama. The author is Mr. S. C. Adams, of Cincinnati, Ohio. The price is $15.

MANUAL OF PATENT LAW, with an Appendix upon the Sale of Patents. By William Edgar Simonds, Counsellor in Patent Cases. Hartford, Conn.: Published by the Author.

A concise and useful little book, explanatory of the patent law and practice.

## Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From July 23 to July 30, 1874, inclusive.

CORSET CLASP.—J. P. McLean, Brooklyn, N.Y.
ELECTRIC TELEGRAPH.—R. K. Boyle, New York city.
ELECTRO-MAGNETIC GOVERNOR.—J. M. Bradford, Portland, Me.
FASTENING SEAMS.—J. W. Davis *et al.*, San Francisco, Cal.
FAUCET.—F. Roach, Boston, Mass.
MATTRESS.—G. N. Torrance (of Philadelphia, Pa.), London, England.
NEEDLE-THREADING HOOK.—H. Wells, Woburn, Mass.
OIL FROM PETROLEUM.—H. W. C. Tweddle (of N. Y. city), London, Eng.
PACKING FOR BOTTLES, ETC.—O. Long, Boston, Mass.
REAPING MACHINE.—W. A. Wood Company, Hoosick Falls, N. Y.
SAFETY LAMP.—B. Tappan, Steubenville, Ohio.
SOLAR COMPASS.—C. T. Pierson, Ramapo, N. Y.
SPECULUM.—E. D. Pape, New York city.
STEAM PUMP.—W. Atkinson, Gardner, Ill.
STEEL MANUFACTURE.—T. S. Blair, Pittsburgh, Pa.
TAPE WEAVING MACHINE.—F. F. Burlock, Birmingham, Conn.
TRANSMITTING MUSIC BY ELECTRICITY.—E. Gray, Chicago, Ill.

# Recent American and Foreign Patents.

## Improved Fireproof Roof.

Frederic J. Hoyt, Batavia, N. Y.—The object of this invention is to render the roofs of buildings in blocks, or where built close to one another, not only waterproof but fireproof. The ordinary flat roof is built on an incline from front to rear, and is covered with a waterproof composition. The front wall is extended a foot or more above the roof. The side walls and rear wall are brought to a level with the front wall, leaving spaces in the side walls near the top, for fitting in joists three feet apart, on which, from front to rear, strips of wood are fastened on edgewise, one fourth inch apart. This is covered with a waterproof composition, on top of which is placed two to three inches of loose gravel, screened so that none will pass through the openings into the lower roof. The water passing through this upper roof falls on the lower roof, and runs off by conductors arranged through the wall and into the lower roof in the ordinary manner, which also serve as air holes to ventilate the space between the two roofs.

## Improved Lantern.

Daniel Lordon, Fremont Center, Mich.—The bottom of the lantern is made double, with a series of holes connecting with a hollow space for purposes of ventilation, a chamber beneath the wick chamber, and a tube, connected therewith, which passes upward through the globe. An oil tube on the globe connects the oil chamber with the wick chamber. A wick in the end of the oil tube may be adjusted to allow the oil to flow to the wick chamber fast or slow. There is an inverted funnel over an opening through the oil chamber connected with the tube by which heat is conducted down beneath the wick chamber. A strong current of heated air passes up through the opening, and is caught by the inverted funnel. The oil in the wick chamber is thus soon heated, and the burners consequently afford a clear and bright flame.

### Improved Expansible Wedge.

Robert Nesbitt, Franklin, Pa., assignor to himself and J. E. Tikiob, same place.—This wedge is composed of two tapering pieces, triangular in cross section, having the outer edge of each piece serrated to prevent withdrawal. A tapering screw engages with a tapering female screw, cut between the two parts of the wedge, and, when driven down, expands the parts.

### Improved Machine for Perforating Paper.

Lyman A. Upson, Enfield, Conn.—This invention consists of a serial punching machine, for perforating duplicate sets of pattern cards for jacquard or figured weaving, and for perforating figures or designs for other purposes, in which the punches are arranged so that, for making different patterns, some of them may be permitted to rise and not perforate, while others are held so as to perforate, the material to be perforated being moved against the punches. A perforated sexagon beam, termed a card cylinder, working the pattern cards of the pattern to be perforated, is combined with the punching machine, and is so contrived that the pattern cards of the pattern to be perforated or duplicated move keys (which act as stops to punches) from over the punches which are not to act, and allow them to rise and allow other keys to remain over those punches which are to act, and retain those in their working position; or the operation may be the reverse of this, moving keys over punches which are to act, and allowing the keys for punches which are not to act to remain stationary. After each operation, there is a plate so combined with the working of the perforated cylinder, and keys which act as stops to the punches, as to return all the keys to their first position for the selection from the whole by the next pattern card, and thus cause the perforation to be made in accordance with the pattern to be duplicated or perforated, whatever it may be.

### Improved Sad Iron.

Charles B. Rathbun and Henry Shaw, Worcester, Mass.—The iron has two holes bored in it close together, near the center of the top, in its longitudinal axis, said holes being slightly inclined from each other from the top downward. The standards are jointed together, and below the joint have the vertical portion fitted to enter the holes. Above the joint they branch apart wide enough to receive a wood handle, which has a rod extending through it, with a screw-threaded projection at one end screwing into one standard, and a square and round projection at the other end passing through a square hole in the standard, and having the cam pivoted to its end. The cam is arranged to press the standards toward the handle when turned downward, so as to cause the parts to bind in the holes, and thus make the handle fast to the iron. By releasing the cam, and shifting the round part of the rod into the hole of the standard, the rod may be turned to adjust the handle for holes, more or less distant from each other, or of different sizes, and to regulate the binding pressure.

### Improved Earth Auger.

Dexter Page, Monticello, Iowa.—The sand auger is provided with valves, which take up the loose substances fed by the cutters of the auger. A cylindrical bucket fits tightly to a rim of the auger, and slides by means of its conical top part on the auger shaft, to which it is firmly applied by a set screw. The conical top prevents the bucket from catching under the curb when working inside or under it. The load of the bucket is readily discharged at the top of the well by loosening the set screw and raising the bucket, the sand flowing instantly out between the auger and the lower end of the bucket. When the bucket is filled with muddy water, the sediment closes every crevice in the bottom and makes the bucket therefore watertight.

### Device for Keeping Steam Boilers Clear of Scale and Sediment.

William O'Brien, Mattoon, Ill.—The scraping frame is composed of longitudinal bars, having cross bars firmly riveted or bolted to them. The two cross bars at the ends of the frame are provided with eyes. Stationary rods are attached to the sides of the boiler, which support the frame by means of these eyes. The frame, as a whole, is an arc of a circle of a diameter corresponding with the boiler. Scrapers are attached to the bottom of each cross bar, which, as the frame is moved back and forth, are placed so as to just clear the bottom of the boiler and scrape therefrom any sediment or scale which may settle on the bottom. This frame is operated from the front of the boiler by means of a rod, which passes through the head.

### Improved Riding Plow.

John H. Payton, Rantoul, Ill.—This is an improved riding or sulky plow, so constructed that it may be readily adjusted to plow deep or shallow, or to turn a wide or a narrow furrow, and may be easily raised from and lowered into the ground. The cutter is rigidly connected with the axle, so as to be entirely independent of the plow, and so as to be held firmly to its work.

### Improved Gang Plow.

Finley B. Crothers, Sparta, Ill.—This improved gang plow is so constructed that the plows may be readily adjusted to cut wide or narrower furrows. The tongue may be moved toward either side, to adjust it for three horses while keeping it parallel with the line of draft, and without moving the line of draft from the center of the machine.

### Improved Car Coupling.

Theo. T. Shotwell, Osage, Iowa.—This invention relates to means whereby great simplicity, efficiency, and economy are imparted to the ordinary car coupling, by dispensing entirely with the complication of parts now in use and combining a coupling pin and crank shaft so that the former is held up by a weight or spring, yields to the pressure of an incoming link, and rises to lock the link as soon as the latter has ceased to bear upon it.

### Improved Bolt Heading Machine.

James and John Kennedy, Plainville, Conn.—This invention consists in several important changes in the ordinary machines for making square necked bolts, whereby the machinery is simplified and rendered less liable to accident, while much greater uniformity and excellence in the manufacture is attained.

### Improved Car Coupling.

Dally S. Moore, Chicago, Ill.—This invention relates to that particular class of car couplings wherein each drawhead is provided with a horn over which the link is passed. The invention consists in novel means for automatically coupling with such a device, and also in means whereby the drawhead may be better adapted to this mode of coupling.

### Improved Churn.

Nathaniel Ewing, Houston, Texas.—This invention relates to means whereby the dashers of plunge churns may be speedily, conveniently, and accurately adjusted to the quantity of milk which constitutes the churning at any one time, and also whereby a detachable churn itself may be easily and securely fastened to a frame just previous to the commencement of the churning operation.

### Surfacing Sheet Iron to Resemble Russia Iron.

John Stackhouse, Allegheny, Pa.—The sheets of ordinary iron of good quality are placed in packs of four sheets, and immersed in a solution of oxalic acid and water. When the iron is heated, the water evaporates, leaving a slight film on the surface of each sheet of iron, which is converted into carbonic acid gas. This gas combines with the iron, and hardens the surface. The surface of the iron is, consequently, left clean, and takes a high polish when sheets are rolled, the iron resembling the best quality of Russia sheet iron.

### Improved Water Wheel.

John W. Ross, Delphos, Ohio.—This invention relates to a turbine wheel in which the buckets are arranged to admit the water at an angle of ninety degrees, between a horizontal and a vertical line. The buckets are formed at the upper end on the inner curve of this dome-shaped chute rim, and they are concaved in cross section on a radius a little smaller than their breadth at the top. From the top they widen downward, so that from the quarter circle of the top they increase to nearly three quarters at the lower end, where, by their spiral curve, they come to the form of an upright trough, from which they discharge the water directly downward. By this curved or dome-shaped form of the chute rim and the upper end of the buckets, combined with the concave shape of the body of the buckets, the water is delivered to the wheel, flowing direct and in solid columns, in which it is most effective.

### Improved Corn Dropper.

Richard Peter Montague, Whitley's Point, Ill.—The frame of the device consists of two side bars and two cross bars framed to each other. To the axle is attached a cylinder, in which is formed a zigzag groove, the sides of which are concaved to receive the ball pivot, which revolves upon a bolt attached to the end of a lever, so that the said lever may be oscillated by the advance of the machine. The lever oscillates upon a long bolt, upon which is placed a coiled spring, which holds the said lever down to its place, and the elasticity of which allows the lever to move up and down upon the bolt as the device changes its position in passing over uneven ground. The forward end of the lever is pivoted to the dropping slide of the planter.

### Improved Harrow and Cultivator Teeth.

Stephen J. Nason, South Berwick Junction, Me.—This invention consists in a double harrow tooth, pivoted so as to be self-adjusting and self-sharpening. The teeth are made double, and the working parts are made in the shape of right angled triangles, placed with their inclined sides forward. The triangular parts are parallel with each other, and are connected at their upper edges by a plate, which is pivoted at its forward part to the harrow frame.

### Improved Damper.

Matthew Howles, Hamilton, Canada.—This invention consists of a damper which is weighted at one side, and provided, at the outside of the pipe, with a notched disk keyed to the projecting end of the shaft. A sliding bar is guided in a case above the disk, and engages the notches of the same, so that the damper is retained securely in any desired position thereby.

### Improved Seal Dip.

Benjamin F. Reinmund, Lancaster, Ohio.—This invention relates to and consists in means by which gas may be transferred from the retorts to the condenser or gas main, with great facility, dispatch, and convenience.

### Improved Washing Machine.

George A. Newell, Wilmington, and John N. Stallings, Kenansville, N. C.—As the water boils, it is forced up the sides of the boiler and clothes holder, and through holes upon the clothes, which will soon become saturated. The squeezer, as it vibrates, expresses this water, which serves as a vehicle for carrying dirt into the bottom of the chamber, from whence it will flow back, through covered holes, to the boiler. This is continued until all impurities are eliminated from the clothes.

### Improved Sewing Machine.

Silas H. Hall, Ottawa, Kan.—The needle has its shank flattened on one side, the socket being of corresponding form; and a notch, in the side, receives a slide to hold it from dropping out when the set screw is loosened. The detachable head holds the needle so as to oscillate it a little, to adjust and line the eye properly. A set screw, for fastening the needle in the head, passes through a slot in a spring, hanging down from the needle bar, and prevents the head from turning too far. There is a clamp and a thumb screw, for fastening the presser to the presser bar by securing a stud on the presser in the eye of the bar, so that the presser may be changed without the use of a screw driver. There is a horizontal slide in a groove, in the side of the stationary arm, with a stud pin, which enters a curved cam slot and operates the needle arm. The slide is worked by a crank on the top of a vertical shaft, which is to be turned by a disk running against the driving wheel, to be turned by friction.

### Improved Center Piece and Cover for Cooking Stoves.

Mary L. Melville and John S. Kidd, Brooklyn, N. Y.—It is proposed to construct pot holes in the top plate in clusters with one or more straight sides, according to the number of pots to be clustered together, and thus adjust them so that the whole of the middle portion over the hottest part of the fire will be covered by the pots, having flat sides and standing close together, and all of the available portion of the heat thereof will be utilized. The invention also relates to hinging covers to the stove, so that they may be turned up and rest on the edge by the side of the pot, and thus save the labor of lifting them off and on the stove. The joints or hinges will be on the straight side; and where two or more holes are used, the covers will be jointed to the cross pieces, so as to swing up between the pots.

### Improved Wheel and Axle for Vehicles.

Sylvester H. Dailey, Olcott, N. Y.—The wheels which revolve upon the axle are made with wide rims projecting upon the outer sides, and having gear teeth formed upon their inner surfaces. The journals of the axle project upon the outer sides of the wheels, and are squared off close to the body of the said wheels, to fit into square holes in the center of bars, which are placed in vertical positions, and to the arms of which are attached gudgeons, upon which revolve gear wheels of a diameter equal to about one third the diameter of the wheels. The teeth of the lower wheel mesh into a gear wheel which runs upon the journal of the axle, and is formed with a sleeve which extends out nearly to the end of the journal of the axle. Upon the sleeve, close to the wheel, is placed a gear wheel, the teeth of which mesh into the teeth of the upper gear wheel. A spring is coiled around the outer part of the sleeve. By this construction, as the vehicle is drawn forward, the draft applied to the axle will act upon the upper part of the wheels, so that less power will be required to draw the machine than would be necessary were the wheels constructed in the usual way.

### Improved Feed Gage for Printing Presses.

John H. Pinks, Woodstock, Vt.—This invention consists of a pair of registering gages for receiving and holding the paper sheets to be printed, mounted on jointed arms which are pivoted to the tympan clamp, and so contrived that they can be shifted to hold paper of any size that can be printed in the press.

### Improved Clothes Dryer.

Dennis L. Huff, Bay City, Mich.—There is a disk to which the arms are attached so as to radiate from the center, and by which they are mounted on the top of the post, to revolve horizontally. The said disk is provided with a spindle. This disk covers the socket in the post, and prevents it from filling with snow and water, by which the spindle would otherwise freeze fast in cold weather. To secure the arms to this disk, the ears on the upper side at the edge and the boss at the center are provided, and a hole is made through the ears and others through the boss, coinciding with them radially, descending from the ears to the center of the boss. On the under side of the disk are strengthening ribs, which unite in the spindle at the center. The post has strengthening ribs and a strengthening collar around it at the bottom of the socket, where it is subject to the greatest strain by the spindle.

### Improved Cotton Press.

John Gramelspacher, Jasper, Ind.—The follower is attached to the cross head, and both are worked by rods. The latter are operated by levers and cramping pawls. There are also griping pawls for holding the rods while the griping pawls let go. The cramping pawls are connected to the levers by a yoke, and they have a spring under them for throwing them up, so as to release the gripe on the rod; also to raise them for taking hold again as soon as the levers let go. The pawls are coupled to the frame by the link, and held by a spring, so as to gripe the rods and hold them against going back. A yoke is provided with each griping pawl to hold it down against its spring and prevent it from griping when it is desired to raise the follower. Bars are attached to the two sides of the press case, with holes at the slots in the sides of the case, to introduce rods above a quantity of pressed material, not enough for a complete bale, to prevent it from springing up while the follower is raised to press in another portion.

### Improved Barrel Head.

Owen Judge, Carbondale, Pa.—The head of this barrel consists of four pieces: two principal pieces which are so much less than semicircles that they may be crowded from the middle to the right and left into the croze, and two short pieces of sufficient width to complete the head, but connecting and lapping at the center. The inner edges of the principal parts are beveled. The smaller pieces are beveled to fit this space, so that when their outer ends are placed in the croze, and they are forced down by the central bolt, they act like a wedge to press the parts laterally, while making tight joints with them in the middle of the head. A nut plate is firmly attached to the center of an anchor piece. Into this a lock is screwed which forces down the pieces to a level and forms a tight head.

### Improved Gas Regulator.

Jules Anselme Crété, Corbeil, near Paris, France.—This is a regulator for gas and other fluids, in which a ball is confined in a tube, through which the fluid passes, and rises or falls as the pressure is greater or less, thus obstructing the delivery. The apparatus consists of a chamber fitted on the gas burner, the water pipe, etc., and formed at its upper part with a central channel of definite section, on the inner surface of which grooves or recesses are formed, which increase the sectional surface thereof. The number and section of these grooves or recesses is so calculated that, supposing the central channel to be obstructed, there will pass through the grooves (which constitute so many distinct passages leading to the burner proper, or to the water outlet) only a desired quantity of gas or water; or, in other words, the regular delivery. The lower part of the central channel is conical, and the body of the regulator is so set that when the delivery of gas or water is shut up, a small sphere rests on a seat at a certain distance beneath the cylindrical portion of the channel or passage. The seat consists of two or three pins, which retain the sphere above the center of the inlet pipe without closing it completely, leaving around the same free passages, while the space between said seat and the grooved channel forms a case or chamber, into which the sphere can rise. The operation is as follows: The delivery cock being shut, the sphere stands resting on its seat. If, now, the cock is opened, and the pressure is superior to two fifths of an inch, the sphere then will rise, and, getting near to the conical part of the central channel, will give access to the burner of only the quantity of gas passing through the grooves in said channel and the annular section existing between said sphere and the channel surface. Should the pressure increase, then the sphere will narrow more and more the annular space, so far as to completely annul it, and the gas will then escape only through the grooves, which are adapted for delivery of a volume of gas sufficient for the normal consumption of the burner. When the pressure subsides, the inverse effect will be produced, the sphere lowering and thus increasing the escape section. When the pressure gets beneath two fifths of an inch, the sphere will drop again to its seat, and the gas will escape through the entire channel and its grooves.

### Improved Pocket Book.

Daniel M. Read, New York city.—This invention consists in an improved fastening for pocket books, etc., in which a part of the main plate is movable, and has teeth formed upon its inner edge to take hold of the catch attached to the flap of the pocket book. The sliding part has an arm, the ends of which overlap the plate to keep the said part in place. The sliding part is moved back by a knob to unfasten the catch, and is connected with the end of the arm by a pin which passes through a slot in the plate. The sliding part is held forward by a spring.

### Improved Artificial Stone.

Ernest L. Ransome, San Francisco, Cal.—This is an improved process for indurating and removing the excess of moisture from artificial stones by the aid of heat and moisture. If the stone contains soluble silica, it is first immersed in a solution of any of the compound silicates. The maximum temperature of the solution should be about 212° Fah. When the stone has been subjected a sufficient length of time to the action of this bath, the stones are removed and placed in a separate vessel. The stones are next surrounded with an atmosphere of about their own temperature, which is moistened by steam, the object being to obtain a greater quantity of moisture in the atmosphere surrounding the stone than would result from the conversion of the moisture in the stone to steam. After maintaining this moist atmosphere at a temperature long enough to convert the moisture in the stone to steam, the amount of moisture is gradually reduced, while carefully regulating the temperature. Artificial stone which does not contain soluble silica need not be subjected to the hot bath, but will be seasoned and indurated by being subjected to the moist atmosphere and subsequent dry heat. By the above described process the surface of the stone is speedily indurated, while heat and moisture are conveniently conveyed to the mass, and by the use of the atmospheric treatment the obnoxious surface cracks, consequent upon variable shrinkage of the mass, and so frequently met with in artificial cement stones, are prevented.

### Transparent Fluid Compound for Engraving Purposes.

Frederick Diffany, Newark, N. J.—This compound is used for engraving with the sand blast when a large surface is required to be cut away, such as in bracelets, watch cases, etc., for example. When it is desired to ornament a bracelet, the pattern is drawn with the compound, and such portions covered as may require to be left untouched by the action of acids or the sand blast. The piece of metal thus prepared is set aside for a few hours until the compound stiffens, when it is ready to be treated with the sand blast, which will rapidly cut away all such parts left uncovered. The compound is composed of benzine, ether, spirits of turpentine, india rubber shellac, dragon's blood, mastic gum, and alkanet.

### Improved Medical Compound or Salve.

James W. Miller, Leesburg, Tenn.—This invention consists of a compound composed of slippery elm bark, the plant known as life everlasting, mullein tops, and pure spring water. These ingredients are boiled down, then beef tallow, mutton tallow, English rosin, beeswax, and neat's foot oil are added. By this method a healing salve is produced, which is a remedy for all descriptions of sores, wounds, bruises, etc.

### Improved Piano Stool.

George A. Ramseyer, New York city.—The standard, which is supported at the ends in the cross bars of the stand, has the nut fitted on it. The nut is provided with the branching arms, which extend above the upper cross bar and support the seat sufficiently above it to allow the necessary play for it to be adjusted to vary the hight. A friction pawl holds the seat, by binding the nut on the standard, and is so arranged that the downward pressure on it by the standard causes it to gripe the standard and bind it fast. By lifting the seat up, the gripe of the pawl is destroyed, and the seat may be raised without manipulating the pawl, but to lower the seat the pawl has to be held away from the standard. The seat may thus be adjusted much quicker than with a screw, and without revolving it.

### Improved Manufacture of Friction Matches.

José J. Machado, Havana, Cuba.—This invention consists of the preparation of the matches with a composition not liable to ignition, except on a prepared surface of amorphous phosphorus, in such a manner that part of the match is covered with a slower burning composition, while the point or end is prepared with greater affinity to the surface for more rapid ignition. The combustible composition is made entirely waterproof by dipping it into a solution of alcohol and tannic acid.

### Improved Driving Rein.

Stillman E. Mathews, Chaska, Minn.—This invention consists of reins or a cord connected to them, arranged through the bit ring, around the bit and under the under jaw, from one side to the other, so that the strain tends to gripe the jaw very firmly between the bit and the part passing under the jaw. By this means a powerful effect is produced on the horse, greatly interfering with his running. It is also proposed to connect the reins to the bit ring by other safety straps, to come into action in case the aforesaid cord breaks.

### Improved Grain Separator.

Frank Johnson, Fredericksburgh, Mo.—To the upper forward part of the shoe is attached a board upon which the straw and grain are received from the thrasher. The upper part of the receiving board is stationary, and the lower part may be hinged to said upper part. The lower edge of the lower part is secured adjustably to the shoe. To the adjustable board are attached fingers about three inches apart, and two feet in length, along which the straw slides while the grain drops through. To the shoe below the fingers, is attached a frame, to which are attached short tongues, which enter grooves in the side boards of the shoe, so that the forward end of said frame may be adjusted higher or lower by shifting it from one to another of said grooves. The rear end of the frame is supported by bolts, which pass through the shoe. To the side bars of the frame are attached cross slats, which are arranged one inch apart, and the forward edge of each rear slat one half an inch below the rear edge of the next forward slat. To their rear edges are attached wires about one quarter of an inch apart, and which project about four inches. The forward edges of the slats are made thicker and are beveled off, so as to allow the grain to pass through, and also to give the blast of air a proper direction to blow off the chaff.

## Business and Personal.

*The Charge for Insertion under this head is $1 a Line.*

**Annealer Wanted**—To take charge of the furnaces in a malleable iron foundry; must be able to give reference, and state where and how long he has been engaged in the business. Address John H. Thomas & Co., Dayton, Ohio.

**Wanted Address**—Maker of coal conveyer. Sam'l M. Van Clief, 27 Rose St., New York.

**Old Battery Zinc Bought**—7c. per pound paid for old zinc battery plates. Parties out of town will please send the above stock C. O. D., and it will receive prompt attention. Thos. Binns, 343 Leonard St., Williamsburgh, New York.

**Manufacturers of Scroll Saws**, send circulars to J. A. Field, P. O. Box 802, Racine, Wis.

**Compound Propeller Pumps**, for Mines, Quarries, Canals, and Irrigating purposes. Circulars on application to Hydrostatic and Hydraulic Company, 912 Ridge Avenue, Philadelphia, Pa.

**To Manufacturers and Amateurs**—Solutions for covering all kinds of metals with different metal, either by Electro Plating or chemical process, always on hand, with reliable direction for use. Address Alb. Lovie, 222 N. 4th St., Philadelphia, Pa.

**The Taper-Sleeve Belt Pulley** cannot be thrown out of balance—has no keys or key seats to mar hubs or injure shafting—no set-screws to catch clothing or belting, or, in slipping, to ring shafting. One Pulley sent on trial to any part of the U. S. A. B. Cook & Co., Erie, Pa.

**A cheap and efficient receipt**, and plain directions for removing scale from Boilers, and keeping them free, will be sent for 50 cents, by H. F. Henry, Box 325, Pittsburgh, Pa.

**A Stationary Engineer wants a Situation**; will take charge of one or more Engines. Can give the best of reference. Address E. F. Shaw, 117 South Second St., Philadelphia, Pa.

**Wanted**—Agents to sell territory for Hoyt's Fire and Water Proof Roof, noticed in this week's List of Patents. Address, with stamp, F. J. Hoyt, Batavia, N. Y.

**Architects and Builders**, send to Charles K. Bill, 753 Broadway, for Catalogue of Photographs of New York City and Central Park.

**For Sale, Cheap**—Second hand Machinist's Tools. D. Frisbie & Co., New Haven, Conn.

**Pattern Letters and Figures**, to put on patterns of castings, all sizes. H.W.Knight, Seneca Falls, N.Y.

**We make to Order Iron and Steel Drop Forgings** of every description. R. A. Belden & Co., Danbury, Conn.

**Wanted Agents Asbestos Felting Co.**, 316 Front St., New York.

**A machine that actually pays its cost in 30 days!** Made by Humphrey Machine Co., Keene, N. H.

**8 H.P. Baxter Engine**, Allen's variable Cut-off, 11x24, Todd & Rafferty 18x42, 45 others, new and 2d hand, with Upright and Horizontal Boilers, Steam Pumps, &c., each fully warranted. Wilson & Roake, Water and Dover Sts., N. Y.

**A few copies of the Manual of Power** for sale. Price $3. Address Sam'l Webber, Manchester, N.H.

**For Sale**—Lathes, Drills, lot of Machine and Boiler Tools. W. McCollum, 223 Pearl St., N. Y.

**For Solid Wrought-iron Beams**, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

**Steam Air Pump Wanted**—A good Second-Hand Steam Air Pump, capable of a pressure of at least 40 pounds. Address J. Barnard, 23 So. 3d st., Camden, N.J.

**Button-Hole Worker**—Patent for Sale—Sample worker sent for 75c. A. W. Webster, Ansonia, Ct.

**Wanted**—Circulars and Price Lists from Makers of small Water Motors, suitable for running light machinery. Address Porter Blanchard's Sons Concord, N. H.

**Safe Investment.**—For Sale—Big Muddy Coal, Timber, and Farm Lands. The whole or one interest in 718¾ Acres of the Big Muddy Smelting Coal Lands, in Jackson County, Illinois. Vein 3 and 6 feet in 80 feet from surface; five improved Farms, with 246 acres under fences; Timber, such as White and Burr Oak, Walnut Poplar, Ash; being 500 acres. The Timber alone will pay for the land. The St. Louis and Cairo Railroad runs through said lands, two miles from Murphysboro, the county seat of Jackson County, Ill. Will sell the whole for $75 per acre, and take half or one third interest. Address Dobschutz & Abend, Owners of three Mines in St. Clair Co., Illinois, Belleville, St. Clair Co., Ills.

**Deane's Patent Steam Pump**—for all purposes—Strictly first class and reliable. Send for circular. W. L. Chase & Co., 95 & 97 Liberty St., New York.

**Spinning Rings of a Superior Quality**—Whitinsville Spinning Ring Co., Whitinsville, Mass. Send for sample and price list.

**Wanted**—The Manufacture of "Specialties" made mostly of Wood. Bayer & Co., Meadville, Pa.

**The Pickering Governor, Portland, Conn.**

**Portable Engines 2d hand, thoroughly overhauled**, at ½ Cost. I. H. Shearman, 45 Cortlandt St., N. Y.

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## Answers to Correspondents

G. X. D. will find directions for removing stains from cloth on p. 171, vol. 30.—C, N. F. will find directions for preparing sumach on p. 71, vol. 30.—G.F. will find a recipe for printer's ink on p. 154, vol. 30, and directions for galvanizing sheet iron on p. 59, vol. 24.—M. W. C. will find a recipe for gelatin (isinglass) cement on p. 27, vol. 30, and for cleaning brass on p. 102, vol. 25.

**J. S. asks:** How small a circle can a small locomotive turn on without causing friction enough to overcome the power of 2 one inch cylinders? The driving wheels are 4 inches in diameter and 6 inches between each driver from center to center, and 14 inches from the back driver to the forward truck wheel. The truck wheels are 4 inches from center to center. A. It will depend upon the play of the wheels on the track. You can strike arcs with different radii, and determine the question after a few trials. By making the intermediate wheels without flanges, you can turn the locomotive in a very sharp curve.

**R. M. says:** The present method for sawing marble is with sand and water, acted upon by a soft iron blade. 1. Can the teeth of a steel blade be hardened enough to saw marble and stand the wear for any time? A. It has not been found practicable. 2. If this would not answer, how would it do to use the steel blade instead of the iron, as we could put a great deal more pressure on it, and naturally do more sawing? A. There would not be any advantage, in our opinion. We believe the diamonds are the only cutters that are practicable.

**J. B. F. R. asks:** How long do you suppose a vacuum could be maintained if formed in an airtight cylinder with a rubber leather piston? A. For ever, if the cylinder were perfectly airtight.

**J. H. A. asks:** What is the rule for calculating the blow of a steam hammer? We have a 300 lbs. steam hammer with a 5 inch cylinder and 12 inches stroke, working at a pressure of 100 lbs. to the square inch. What is the weight of the blow with the hammer working at full stroke? A. We do not know of any rule by which you can calculate this.

**R. G. R. asks:** Can you inform me of a cheap method of consuming the smoke, or part of it, from soft coal, in a furnace under two tubular boilers 42 inches by 12 feet each? A. A common plan, which is frequently successful, is to admit air to the products of combustion, after they leave the furnace. Others admit air to the furnace, above the fire. You will find a great deal of interest, in this connection, in Mr. Charles Wye Williams' works.

**V. A. says:** I have lately had an argument with a friend on the subject of the ball dropped down a hole through the earth's diameter. The subject, being conjectural, cannot of course be submitted to experimental research; but inasmuch as some of the well known principles of matter may be involved, we have agreed to abide by your opinion. He asserts that the ball, on arriving at the earth's center and losing its weight, also loses its momentum, and will come to rest without passing the earth's center. I am inclined to disagree with him on the ground that his assertion is at variance with the theory of conservation of force, and am of the opinion that the ball will oscillate for ever from end to end of the diameter, provided that frictional or retarding media, such as air, etc., be excluded. Your opinion is respectfully sought on the question. A. We incline to your opinion.

**W. S. B. asks:** 1. Is the use of tobacco by smoking it injurious to the teeth? A. Yes. 2. If so, what part of the tooth does it first affect? A. It affects the upper part of the teeth, near the gums. 3. What effect does it have on the brain, if any? A. There is no doubt that the use of tobacco has an injurious effect upon the brain. "Tobacco smoking excites an abundant secretion of saliva; hence some persons maintain that tobacco smoking aids digestion. Smoking acts on the intestines as a slight purgative, and no doubt a pipe or cigar smoked after breakfast is beneficial to some persons. Smoking to excess is no doubt a very harmful habit; it disorders digestion, greatly lessens the appetite, produces much restlessness at night, and weakens both mind and body. Chronic pharyngitis, and chronic dyspepsia in some instances, may be clearly traced to smoking in excess. Even amaurosis is said to be sometimes produced by excessive smoking. Kölliker teaches that nicotine quickly paralyzes the brain and destroys voluntary movement."—(*Ringer.*)

**L. C. T. asks:** With what tasteless composition can I coat the inside of a keg to make it air and gas tight? I have tried rosin 8 parts to 3 of beeswax, melted and poured in, but without any good effect. I think that the heat from the composition causes shrinking of the staves, which cannot be tightened after the composition sets or cools. A. Take an aqueous solution of gelatin, about 1 quart of gelatin to 3 quarts of water. Heat the barrel and pour in the gelatin solution boiling hot. Revolve the casks several times until you are satisfied that the gelatin has reached every part of the cask. Draw off the remainder. Allow the cask to become cold. Then pour a solution of tannin in water into the cask, in the same manner as the gelatin, except that during this process everything must be cool. Draw off the tannin solution and allow the cask to remain undisturbed for two or three hours, when you have a solid coating, upon the inside of the cask, of tannate of gelatin.

How can I make root beer? To make root beer, take 3 gallons of molasses, add 10 gallons of water at 60° Fah. Let this stand 2 hours, then pour into a barrel, and add powdered or bruised sassafras and wintergreen bark, each ¼ lb., bruised sarsaparilla root ½ lb., yeast 1 pint, water enough to fill the barrel, say 25 gallons. Ferment for 12 hours and bottle.

**J. T. P. asks:** 1. How much greater would be the heat in a box, filled with steam through a perforated pipe, with the pressure in the boiler at 40 lbs. than at 20? A. Temperature at 40 lbs. would be 287° Fah.; at 20 lbs., 259° Fah. 2. Is there any instrument for measuring the heat in such a box? A. The temperature can be measured with a thermometer.

**J. B. R. asks:** What is the best method of extracting tannic acid from new white oak wine casks, so as to make them perfectly wine clean? A. Ether is the best solvent, but being expensive you can use alcohol in its place. The alcohol can be used again, if purified by distillation.

**L. G. D. asks:** How can I prevent the bodies of butterflies and moths from becoming oily, and secure those that are already oily from becoming more so? I do not wish to cut out the intestines, as that makes the body look unnatural. A. Soak the insect in benzine by dropping the liquid upon its thorax, continuing this until the insect is thoroughly impregnated even to the tips of its wings; then dry in the wind. Pin the insect under a window raised a few inches, or any other place where a sufficient draft of air can be obtained. The moth should be placed with its head pointing inside, so that the inrushing air may blow up the feathers of the insect and prevent them from becoming plastered or stuck to each other.

**S. L. asks:** Can you give me a simple process for making bone black or animal charcoal, used in the manufacture of blacking? A. Put clean bones in a crucible, close, and expose to strong heat till calcined. Cool the crucible, remove and powder the contents, wash them in warm water, and dry.

**G. H. asks:** What is the process of staining glass, such as is used for church windows, etc.? A. The different compounds for painting on glass are glasses of easy fusion, colored with ground metallic oxides and laid on the glass with spirits of turpentine.

Will light, in passing through such glass, assume its color and transmit it to any object upon which it may be reflected? Will liquids so transmit their colors? A. Yes, in both cases.

**G. K. asks:** How can I mix a cement that will harden under fresh or salt water, in 24 hours or less, and be of a hard and durable nature? A. You do not state what use you want to make of the cement. There are several hydraulic cements; the following is one: Powdered clay 3 lbs., oxide of iron 1 lb., boiled oil to form a stiff paste.

**P. J. K. asks:** I do not quite understand how it is proved that the earth is round, by viewing a ship on the ocean. The geography books say that the first part of a ship that is seen is the tip of the mast. How can this be, as water cannot be round, as it always seeks its level? A. Your idea as to water "finding its level" is erroneous. Water, by gravity, assumes the spherical form on the earth's surface; and the rotundity of the earth can be demonstrated by the means you describe as well at sea as on land.

**R. S.**—The phosphorus light you mention is well known, and has been described in our columns.

**C. W. says:** On August 3 a brilliant star was seen in the west, immediately after sunset; it was as bright as the sun, and gradually faded away till nothing could be seen of it. What was it? A. Probably one of the meteors which are so very numerous during this month.

**J. C. S. says:** I wish to make some marine glue; in your excellent book of "Instructions for Obtaining Patents" you give directions for making the same, namely: Gum shellac 3 parts, caoutchouc 1 part; dissolve in separate vessels in ether free from alcohol, applying a gentle heat. An encyclopædia says, respecting ether: "Its odor is peculiarly powerful and penetrating if inhaled, producing insensibility to pain, etc. Great care should be taken not to pour it out with a flame below it, otherwise an explosion of a dangerous character might ensue. Mixed with certain proportions of air, it forms a highly explosive compound." I must confess that, in the face of the above, I should be afraid to use ether for making glue until I hear further about it. A. If proper care be taken, the danger is small. Keep in airtight vessels in a cool place. We cannot see the necessity of pouring the ether out with a flame beneath it.

**W. A. P. says:** Please give me a recipe for glue that will be tough and strong, to fasten emery to leather. A. Marine glue, made of shellac and india rubber dissolved in naphtha, will probably answer well. It is recommended by some to add a little milk to ordinary glue, in securing emery to leather.

**H. W. N. asks:** Which goes the fastest, a shell boat pulled by two persons, using two oars apiece 10 feet long, or one pulled by two persons using one oar apiece, 12 feet long, weights being equal? A. This is scarcely a matter of theory, but is one of those questions which should be decided by direct experiment.

**G. E. H. asks:** Can a belt be laced so that the lacing will not be crossed on either side, and at the same time be strong enough to hold from pulling out on a belt that has to be so tight as to be stretched on to the pulley by clamps? A. We think it is better for the lacings to cross.

**C. M. P. asks:** How can I keep metal boxes from getting loose? Is there anything you can put on the iron before you run the metal that will make the latter stick? A. The iron should be recessed or provided with holes to retain the Babbitt metal in position.

**C. H. H. asks:** What is wire drawing in a steam engine? A. It is a reduction of the pressure of steam by contracting the opening through which it passes.

How is the hammer test applied to steam boilers? A. By tapping the boiler gently with a light hammer, and judging by the sound whether the iron has deteriorated.

**B. asks:** Is not an asymptote a line which, approaching a circle, continues to infinity without touching it? A. An asymptote is a straight line which continually approaches nearer to a curve, but never meets it. The straight line is continually dividing the distance between itself and the curve, so that, between two successive equal lengths of the straight line, the distance between the curve and the straight line is only a fraction as great as it was before; but as there will always be some distance to divide, the two lines will never meet.

Can two bodies approach each other from opposite directions in the same line, without meeting? A. The possibility of the two balls continually approaching, and never meeting, might be conceived. Imagine them to be subject to a law by which the space through which they moved in one second was always half the distance between them at the commencement of that second. Then if the distance between them at any given point were 2 feet, it would be after 1 second, 1 foot; after 2 seconds, ½ foot; after 3 seconds, ¼ foot; after 4 seconds, ⅛ foot, and so on; and if the law were unchanged the balls would never meet.

**L. B. asks:** Will a common cotton boat, usually called in South Carolina a mountain boat, propelled by an engine instead of poles, be subjected to United States inspection, and be required to have a licensed engineer aboard? A. Yes.

**A. W. S. asks:** Having run an engine for two years, I want to learn to be an engineer. Can you tell me where to go to learn more of the business? A. You need shop experience and education. Cornell University furnishes both. You could enter a machine shop and employ your spare time in study.

**J. H. N. asks:** What horse power steam engine is necessary to perform work on a farm, such as grinding, sawing, etc.? A. From 3 to 5 horse power.

What is the capacity, in the indicated horse power of a steam engine, of a two horse tread power, elevated and driven by horses, in the manner usually done by threshers? The horses are to be of medium size and capacity. A. From 3 to 4 horse power.

**I. asks:** A friend of mine affirmed that the revolutions of a wheel could be indefinitely increased by the use of a number of multiplying wheels, without increasing the motor power. I averred that this could not be done without increasing the motor power, for the weight of the wheels would counterbalance the rapidity of the motion; and that finally the mechanism would become so heavy that the number of revolutions would no longer be increased. Who is right? A. Every additional connection would require some power to drive it, and therefore your friend is in error.

**J. R. S. asks:** Is it a fact that ice houses take fire by spontaneous combustion? If so, I would like a scientific explanation of the matter. I have noticed that there have been quite a number of ice houses burned this season, and that the cause was attributed to spontaneous combustion. One was burned in Massachusetts on the night of July 31. The building was 40x30 feet, with 20 foot posts made as tight as possible, with no means of ventilation; it was filled to the plates with ice packed in fine sawdust. The parties owning the ice had a quantity in another building packed in small hay: after using the ice that was packed in hay, they dried the hay and spread it upon the ice in the ice house. Four days after the building was discovered on fire, the fire bursting from the roof. A. We are not aware of any other case in which the origin of a fire in an ice house has been attributed to spontaneous combustion, although the burning of ice houses is a somewhat frequent event. Workmen so commonly smoke pipes about their work that we would be inclined to attribute the origin of these unfortunate disasters more to this cause than to any other. We would be pleased, however, to receive from our correspondents any additional facts bearing upon the subject. As to providing special means of ventilation for ice houses, we understand that it is considered by many essential to the proper preservation of the ice to do so,

**S.E.J. says:** If we have a plane surface containing a square foot or yard, how much more pressure will there be on it when it is placed so that the wind can blow square against it, than when it is placed at an angle of 20°, 30° or 45° to the wind? A. Experiments have not been sufficiently extended to enable this question to be answered exactly. Robins and Borda's experiments, however, seem to show that the pressure on oblique surfaces varies nearly as the sine of the angle of incidence.

**C. D. says:** Please give me the number of figures that it requires to make a billion. A friend says that 3,750,340,240 stand for three billion, seven hundred and fifty million, three hundred and forty thousand, two hundred and forty; and by consulting the arithmetic I find that he is right; but when I go to Webster, I find that it requires a million of millions to make a billion, which would be 1,000,000,000,000, or 13 figures. A. In French numeration, commonly employed in this country, a billion is a thousand millions. In the English numeration, as given by Webster, a billion is a million millions; and the first example, read by the English numeration, would be three thousand seven hundred and fifty millions, three hundred and forty thousand, two hundred and forty.

**A. L. K. asks:** What are the three and five cent pieces (now in use) composed of? A. Three fourths copper and one fourth nickel. The five cent piece weighs 77·16 grains; and the three cent, 30 grains.

**G. A. says:** J. S. S. says that he runs one pair of burrs (or rocks, as he calls them) on 40 lbs. of steam. I should like to know the size of his boiler and engine, also the size of stones, and kind and quality of work done. I have a tubular boiler, 10 feet long and 4 feet in diameter, with 72 two inch tubes, with a grate surface of 16 square feet. The engine has two cylinders, 5½ inches bore x 12 inches stroke, running 103 revolutions per minute, cutting off at ½ stroke. We cannot run with 40 lbs. of steam; with 60 lbs., we cannot grind over 100 bushels of corn in 10 hours into feed meal. I think we have a good boiler. The engine will not give us the amount of power we want. Will you give us your opinion, and will J. S. S. further explain his case? A. It might be well to run your engine faster. A good engineer could readily ascertain whether the machinery is doing as well as it should. We should be glad to hear again from J. S. S., in answer to the present correspondent's inquiries.

**C. J. W. asks:** 1. Given a set of four boilers, placed side by side; the steam is taken from each through a 4 inch pipe which is carried directly to the front and connected with a 6 inch pipe running parallel with the fronts. From about midway between the ends of this last, a 6 inch pipe is taken to the engine. The total distance from the boilers to the engine is about 70 feet, and in this distance there are four right angles. The steam drums and pipe are all exposed to the air. Is there greater condensation on account of the right angles? If so, is it appreciably greater? A. Yes, to both queries. 2. Is the condensation probably much greater on account of exposed condition of drums and pipe? A. Yes.

**M. C. H. asks:** As to the relative properties of air and steam, which is the most compressible, that is, the most elastic? If two boilers were charged, one with steam and the other with air, each compressed to a pressure of 100 lbs. to the square inch, and one of two engines of the same size be attached to each boiler, which would give the greater number of revolutions, everything else being equal? A. If utilized to the best advantage, the steam would give the greatest number of revolutions, since it can be condensed, while air is a permanent gas.

**O. S. asks:** Suppose a bottle, weighted with shot and so adjusted as to submerge it one inch below the surface of the water, be made perfectly tight, would the bottle continue to sink, until it reached the bottom, regardless of the depth, or would it find its equilibrium, and remain suspended between the bottom and surface? A. The bottle would continue to sink as long as its weight was greater than that of an equal volume of water; when the two became equal, then the bottle would come to rest.

**S. S. says:** I have two wells, 436 feet apart. Which is the cheapest way to arrange a windmill to pump the water of both wells with one pump? One well is 20, the other 25 feet deep. A. About midway between the two wells, but far enough away from the center, towards the deepest well, to compensate for the greater lift.

**R. H. F. says:** On p. 101 of your current volume, the following passage occurs, in reference to making screw dies: "Make an allowance for shrinkage in hardening, for all holes shrink in hardening." This I believe to be erroneous. Let some of your young readers test it; it may help to teach them methods of careful investigation. Take good steel, soft, and drill a hole accurately in it; take the same steel in the same condition (not having heated it meantime) and fit closely and very accurately the hole thus made, harden the steel with the hole in it, and apply the round steel in the hole; if it will not enter at all, it is clear that the metal containing it has expanded inwardly; if it enters as before, otherwise. Now harden the steel that has been fitted in the hole, and it will be found not to enter the hole, whether the metal of the latter be hard or soft. Suppose that steel of proper dimensions be given an even and finished surface, and a true and delicate circle be drawn thereon; then let the steel be hardened and the diameter of the circle be remeasured. The result, no doubt, would be an enlarged diameter, and that in consequence of the tension of the metal within the circle. I believe that, if no metal were there, the circle would be unchanged; otherwise, if the circle were diminished, it would be contraction of the metal about the margin of the hole, not expansion in hardening. A. If an inch hole be bored in a piece of soft iron or steel, and the iron or steel be then hardened, the hole will be less than an inch. If a piece of round iron or steel, an inch in diameter and 6 inches long when soft, is hardened, it becomes more than an inch in diameter and more than 6 inches long. A circle described on a solid face would enlarge from hardening; but if the metal were cut away round the inside of the circle, it will then become smaller. It is obvious that in the one case the metal inside the circle expands and forces the circle outwards, therefore enlarging it; while in the other case, there being no obstacle to the metal finding room to expand inwards, it does so.

**E. H. M. says:** I have in daily use twelve tanks (or, more properly, casks), holding about six hundred gallons each. They are built of best Michigan two inch oak, and are used for receiving spirits, about proof in strength. They oftentimes leak. What is your opinion of an application of paraffin outside, and what method would you suggest for an inside application, to be put on without taking end or head out? Would a satisfactory result be reached by placing sufficient paraffin in at the bung and rolling the cask about till the material is wholly taken up? If any remain in the cask, would the paraffin combine with the spirit or give it any flavor? Is it solid or liquid? If the former, how shall I manage for the purpose named? A. Paraffin at ordinary temperature is a solid. It melts at 45° to 65°. We think it would be best for you to try an outside coating of paraffin on the parts which leak. It would be difficult to line the inside without taking out the head. To apply the paraffin, melt it in an iron vessel and pour on the parts to be treated; then use a hot piece of iron to rub the cooled paraffin down smooth.

**E. L. S. asks:** Why does the German student lamp flicker, even with a new wick? A. You do not use the best of kerosene. These lamps absolutely require it.

**J. C. E. asks:** Is it beneficial to a heavy rubber belt to keep it well coated with paint? A. It will be decidedly injurious, causing the belt to crack and eventually to tear.

**G. B. S. asks:** What is the principle of the lactometer? Is it anything like the hydrometer? If not, in what respect does it differ? A. Hydrometers are of two classes. 1, of constant volume but variable weights; 2, of constant weights but variable volume. Hydrometers of the first class are used to determine specific gravity. Hydrometers of the second class (of which the lactometer is one) do not determine the specific gravity, but merely show whether a liquid is more or less concentrated. Pure milk is liable to great changes in strength (owing to change of food, wet, damp weather, etc.), so that the lactometer is not to be relied upon to detect adulterations.

**J. M. T. asks:** 1. Are resonators made as an article of trade? A. No, not in this country; they can be obtained at Munich. 2. Have they any definite form? A. They generally have a globular shape, resembling in their external form a small mortar. 3. Should they be constructed of any particular substance? A. Helmholtz' resonators, one of which may be seen at the Stevens Institute, Hoboken, are made of plaster of Paris. 4. Is it the mass of air contained or the column that causes resonance? A. The enclosed air is the sonorous body and the substance of the globe has scarcely any influence on the tone. It is the volume of air which causes resonance. 5. Should the opening be of any specific size? A. The opening should have a definite size

**M. A. W. says:** There are several marks on my face, the result of scratching while having the smallpox at the age of 7. My age now is 19. I have outgrown many of the marks, but the remaining ones give my face a somewhat rough appearance. Is there any possible way of removing them? A. Age is the only remedy.

**R. H. P. says:** If I dissolve 1 lb. of Malacca tin in muriatic acid, and then precipitate the tin with zinc, how can I recover or bring back the precipitant to metallic tin? Can it be done in a lead crucible, and at what temperature? A. Precipitated tin can be reduced in a graphite crucible by mixing it with cyanide of potassium and a little carbonate of soda, and covering the charge with a layer of common salt. The fire should be a bright red and the crucible should be left in 25 to 30 minutes. The sample sent is not precipitated tin. Two assays of the sample were made, and failed to obtain tin; but instead, obtained iron. Are you sure about its being Malacca tin?

**W. H. K. Jr. asks:** What ought to be the thickness at top and bottom of two square brick stacks respectively 100 feet and 140 feet high, each having an 8 feet square flue for the entire hight? A. For the 100 feet stack, make the walls 3 feet thick at bottom and 16 inches thick at top; and for the 140 feet stack 3 feet 8 inches thick at bottom and 16 inches thick at top, the brickwork being of hard brick and cement mortar. [This answer was incorrectly given in our last issue.—EDS.]

**J. W. M. asks:** How can I fasten ornamental center pieces, made of plaster of Paris, on to plastering? A. Stucco center pieces and ornaments of all kinds are put up after the second or brown coat of plastering—and sometimes the finishing coat—is put on. Make a number of holes in the plastering down to the lath, and then fill them with white mortar, gaged or tempered with plaster of Paris; wet the ceiling well, and ornaments, at bottom; you can then stick them on with the gaged mortar as you please; and if well bedded into it, they will adhere. Clean off all loose mortar with a plasterer's brush and plenty of clean water, after they are set.

How can I polish plastering, when the last or white coat is of lime and plaster of Paris? A. In hard finishing walls, plasterers use an oleaginous substance called "elbow grease," by which they imply that the polish is put on mainly by much and hard troweling. Use clean washed white beach sand in your finishing coat of lime and plaster; take your brush in one hand and your trowel in the other; first apply clean water and then follow it with the trowel, and repeat until the plaster sets and shows a polish.

**J. P. asks:** Has a common underground cistern, well secured with the best of hydraulic cement, ever been tried as a receptacle for wine? When the cement is well set, would it be detrimental to the wine or the wine to the cement? A. We are not aware of any instance of the kind, and would not advise you to try it. The value of wine depending so much upon a certain delicacy of flavor, it would not be safe to subject it to the action of the crude materials of which such a receptacle would be made.

**W. G. R. asks:** How can I test the effect of frost upon samples of artificial stone? Can I do it with sulphate of soda? A. Experiments of the kind referred to have been made by Professor C. F. Chandler, of the School of Mines, whom you may address at East 49th street, corner Fourth avenue, in this city.

**C. M. M. asks:** 1. How much power will it take to run a 24 inch planer? A. It depends a great deal on the speed at which you wish to run the machinery, and the depth of cut. It would be well to allow at least 10 horse power. 2. How much power is required to run a common wood lathe for turning table and bedstead turnings of walnut and maple? A. Allow 2 horse power. 3. How much power is required for running a 16 inch circular saw for ripping 2 inch white oak plank? A. Allow 15 horse power. Of course, you can use a great deal more or less, as you desire, in each case.

**W. P. asks.** What size and power of boiler would it take to heat with steam 4 rooms of 7,000 cubic feet each? Are $2\frac{1}{2}$ feet radiating surface sufficient per hundred cubic feet of room? A. Under ordinary circumstances, a boiler that will evaporate from $1\frac{1}{4}$ to $1\frac{1}{2}$ cubic feet of water per hour ought to be large enough.

**F. H. asks:** 1. On a tramway, 1,400 feet long, will a full wagon, weighing 10,000 lbs., have sufficient tractile force to pull up the empty one, weighing 2,000 lbs., if the incline is only 1 in 400? A. Yes, if properly arranged. 2. What power of engine would be required to convey (by means of endless wire ropes) these full wagons, bringing them on the return, empty? A. About 10 horse power. Your other questions are of purely personal interest, and you should apply for answers to manufacturers and dealers.

**H. B. asks:** How many cubic feet gas would be required to lift one pound weight? A. Taking it for granted that hydrogen gas is meant, it will require about 14 feet of nearly pure gas, as from the action of zinc upon acidulated water. Of common street gas (carburetted hydrogen), it would require about 30 feet to lift one pound weight.

What would have to be the size of a vessel to contain 20 cubic feet? A. A spherical vessel (balloon) about 3 feet 4 inches in diameter will hold about 20 feet.

**F. Y. asks:** What will remove tan from the face, hands, and other portions of the body without injury to the skin? A. Take of corrosive sublimate 5 grains, muriatic acid 30 drops, lump sugar 1 oz., alcohol 2 ozs., rose water 7 ozs.; agitate together till all is dissolved. Apply night and morning.

**M. S. H. asks:** In boiling (or in keeping in hot water below boiling point) tinned articles in lye water to remove rosin, etc., the tinning sometimes becomes colored or stained dark, like lead. Can this be prevented by anything in solution in the lye water (that will not stain silver), or is there any simple way of brightening up the tinning, otherwise than by polishing? Could the darkened parts be varnished by some bright colored lacquer that would give it a nice appearance? A. We have tried the experiment of boiling the tin with rosin in lye water; but the tin was not discolored. We cannot say, without having suitable specimens of the discolored tin, what would remove the stains in the way you desire.

**J. F. asks:** Is there any agent except peroxide of hydrogen (which I cannot obtain) by the application of which the whites of paintings (particularly water colors) which have been blackened by sulphuretted hydrogen gas may be restored without injury to the material on which they are painted, or to those pigments with which the white lead is associated? A. Peroxide of hydrogen is the only thing we have seen recommended for the purpose.

**C. G. B. says:** Please give me a full description of Robinson's anemometer, the size of wheels and number of teeth and pinions, also the size of cups, as used in the United States signal service. A. Robinson's anemometer consists of 4 metallic cups in the form of hemispheres, on 4 arms at right angles. They are supported so as to turn freely about a vertical axis. The plane of the base of each cup is perpendicular. The action on the convex surface is less than on the concave surface, hence motion is produced. Making no allowance for friction, the center of each hemisphere moves with $\frac{1}{3}$ of the velocity of the wind. An endless screw on the vertical axis gives motion to a series of wheels which can register the wind's progress to 1,000 miles. The anemometer used by the United States signal service is essentially Robinson's, but the special arrangement of the wheels, etc., is a patented improvement.

**C. F. C. asks:** 1. What are the proportions used to sensitize the collodion for taking photographs by the new method, without using the silver bath, and also the best developer and fixing solution? A. The following are the proportions of the materials as given by Colonel Stuart Wortley in his new dry plate process, wherein the usual bath is dispensed with: Plain collodion 1 oz., pure anhydrous bromide of cadmium 7 grains, nitrate of uranium 20 grains, nitrate of silver 18 grains. To purify the nitrate of uranium: Dissolve one part in two parts of ether, and let stand for some hours. The water of crystallization in the uranium will fall to the bottom, leaving a top layer of pure uranium, and it is this top layer which is used for the preparation of the emulsion. It is desirable that this purified uranium should have an acid reaction; and if it has not, add to it a minim or two of acid per ounce. Nitric acid is to be preferred, taking great care not to use too much. A strong alkaline developer is to be preferred. If very sensitive negatives are required, or very rapid development, use bromide in the developer in minimum quantity; if, on the contrary, you wish to be slow and sure, use plenty of bromide and take time for development. The light in the room must be as orange as possible, more so than for the wet process. The following is the composition of the developer: Carbonate of ammonium solution (ninety-six to the ounce) forty drops; bromide of potassium (same strength) ten drops; pyrogallic acid solution, alcohol (same strength) twenty drops; water, one ounce. 2. I am at a loss to produce good sensitive paper; please to tell me how it is albumenized and how to fume it. A. To albumenize paper: Take chloride of ammonium 200 grains, water 5 fluid ozs., albumen 15 fluid ozs. Take the albumen from nearly fresh eggs, taking care not to break the yolk. Mix the ingredients and beat into a froth. Skim off the froth as it forms and place in a flat dish to subside. When the froth has partially subsided, transfer it to a tall and narrow jar, and allow to stand for several hours, that the membranous shreds may settle to the bottom. Then pour off the upper clear portion, which will be fit for use. To apply albumen, pour a portion of the solution into a flat dish to the depth of $\frac{1}{2}$ inch. Then take a sheet of paper by the two corners, bend it into a curved form, convexity downwards, and lay it upon the albumen, lowering the corners. The upper side remains dry. Allow the sheet to remain one minute and a half, then raise it and pin up to dry. To render the paper sensitive: Take nitrate of silver 90 grains, distilled water 1 oz. Lay the sheet upon the solution in the same way as described for albumen; 3 minutes is sufficient contact for thin paper, and 4 to 5 minutes for thick. Finally hang up to dry. 3. Can positive pictures be taken on the glass with the same process as negatives? I would not trouble you with these questions, but, living in the Sandwich Islands, I am so far removed from civilization that it is difficult to obtain books, and the SCIENTIFIC AMERICAN is my constant companion. A. Collodion positives, taken directly, need an image which is feeble though distinct. Iodide of silver is substituted for chloride, and a developing agent is employed. The surface of the reduced metal must be whitened as much as possible. The developer should consist of sulphate of iron. To produce a dead white tint, use with acetic acid. The addition of nitric acid to sulphate of iron modifies the development, making it more slow and gradual. Too much acid must not be used. It is best that the nitrate bath should be acidified by nitric acid instead of acetic acid. It should be tolerably concentrated. In regard to the collodion, if it is the ordinary iodized collodion, it should have some bromide added to it. The operator must be guided by the aspect of the developed image as to the necessary quantity of bromide to be added. If the high lights appear too dense, more bromide must be added. If, however, the positive is gray and feeble, and this is not due to over exposure, the proportion of bromide may be reduced.

A correspondent sends us the following recipe: "Blacking consists of a black coloring matter, generally bone black, and substances which acquire a gloss by friction, such as sugar and oil. The usual way is to mix the bone black with sperm oil, sugar, and molasses; a little vinegar is then well stirred in, and strong sulphuric acid is gradually added. The acid, acting on the salts of lime in the bone black, produces sulphate of lime and a soluble acid phosphate; the sulphate forms a tenacious paste with the other ingredients, which can be spread very smoothly; the oil serves to render the leather pliable. This forms a liquid blacking: paste blacking contains less vinegar. According to Liebig, in Germany blacking is made as follows: The bone black is mixed with one half its weight of molasses, and one eighth its weight of good olive oil; to which are afterwards added one half its weight of hydrochloric acid and one fourth its weight of strong sulphuric acid, mixed up with water to an unctuous paste." He asks: Is not the acid bad for the leather? A. Bone black consists of carbon 10 parts, phosphate of lime 84 parts, carbonate of lime 6 parts. Assuming the bone black to equal 100 parts, the hydrochloric acid 50 parts, the sulphuric acid 25 parts: there will remain 5 parts of acid not taken up by the bone black. These 5 parts will be held in solution by 50 parts of molasses, and 12·5 parts of olive oil, and water enough to make an unctuous paste. By this great dilution, the acid loses all power to damage the leather.

**W. H. S. asks:** 1. How can I make white linen or cotton waterproof without discoloring the fabric or covering the texture? A. Pass the linen through a hot solution of weak glue and alum (1 oz. of alum to 2 qts.) with a few pieces of soap added. 2. How can I make an adhesive substance that will not discolor white linen? A. Use white glue. 3. What kind of varnish or other transparent substance will give linen a durable and finishing polish? A. A little paraffin added to starch will give it a brilliant gloss.

**M. S. says:** I have a 12 inch belt (double thickness) connecting shafts 40 feet from center to center, with an idler 4 feet 8 inches from the driven shaft. What amount of power will I gain by putting the idler half way between the two shafts? A. Unless the belt is very stiff and unyielding, we do not imagine that there will be any appreciable gain.

**H. P. asks:** Do you think the moon has anything to do with rain? A. We have no conclusive evidence that the moon has anything to do with rain or in any way affects the weather except perhaps in tending to cause the disappearance of clouds under full moon.

Is there any danger in testing a boiler by filling it full of water and then slowly heating it? A. This is a method that we have frequently recommended.

What is the best color for painting the cylinder and steam chest of an engine? A. There is a black varnish made from mineral oil that seems to answer very well.

**L. B. asks:** Which way will a moving railroad car be brought to a standstill the quickest, by applying the brake tight, allowing the wheels to revolve or by applying the brake so that the wheels will stop revolving and slide along on the rails? A. The former way.

**G. P. S. asks:** Are there any self-switching engines in use? A. Not that we know of.

Is water compressible by freezing? A. It expands.

What is the velocity of a gale at an elevation of 100 feet above the surrounding country, and what is the pressure per square foot? A. Velocity about 50 miles an hour, and force more than 12 lbs. per square foot.

Are there any self-running solar cameras in use? A. Yes.

**C. A. asks:** What is the highest speed ever attained by any locomotive or train in the United States? A. Probably not much more than 60 miles an hour, though there are accounts of much greater speed.

Is the dummy engine used to a great extent throughout the State of Pennsylvania, and what is the usual speed? A. It is not very extensively used. The speed is from 12 to 15 miles per hour.

Is there any difference in the speed of the locomotives of this country and Europe? A. The average speed of express trains in England is, we believe, greater than in the United States.

**J. R. F. asks:** In conversing about the Catline process for making wrought iron, practiced in Northern New York, I was told that the workmen believed that the iron necessarily contained silver; and that if the silver were extracted by means of a loadstone, the iron was thereby rendered worthless. What is the origin for such a belief? A. We never heard of this theory before.

**S. L. W. asks:** I was once operating a plain slide valve engine, with pendulum governors. I would sometimes check up the speed, which then would run so slow that the governor would not have any effect on the engine. Having one cylinder cock open, the steam would rush out of it at intervals and the speed would increase as if the governor valve were in motion. Was this caused by the eccentric valve not being set correctly? A. This is very common with many governors which are not sensitive enough to provide for great and sudden variations in work. There does not seem, from your account, to be anything wrong in the setting of the slide valve.

Is there any such a thing as a Chinese sensitive leaf or plant? A. There is a sensitive plant, occurring principally in the tropics of America. Any flower raiser could doubtless procure one for you.

1. How many miles per hour will a 10 horse power portable engine propel a flat boat, 60 feet long, 25 feet wide, with side wheel and breakwater? The boiler is to carry 100 lbs. steam, and the paddle wheels are to be driven with a belt from the engine. What would be the tunnage of such a boat, and how much water would she draw when loaded? A. Probably about two miles per hour. You can readily calculate the tunnage and draft by allowing 35 cubic feet displacement for each tun weight of the vessel and cargo. 2. This boat being my own property and carrying freight for the public, would the steamboat law compel me to have licensed officers, and also to have my boat inspected? A. Yes.

**F. H. L. asks:** What is the process by which brass is tempered? A. It is done by hammering or rolling.

**C. M. B. says:** I made me an engine last winter with a cylinder 2x3½ inches, which I am using to run a small wood-turning lathe; the boiler is 12x30 inches and 1-16 of an inch thick. I am working steam at 50 lbs., and a friend tells me that my boiler will explode, for the iron should be as thick for a boiler 1 foot in diameter as for one 4 feet in diameter, the steam pressure being the same in both cases. Is he right, and am I working my boiler at an unsafe pressure? It is strongly made with doubly riveted joints. A. Your friend is in error. A boiler four feet in diameter would only safely sustain one fourth of the pressure that could be maintained in one similarly constructed but only one foot in diameter. The pressure of 50 lbs. is not excessive, if the material and construction of your boiler are first class.

Would it not be advisable to galvanize the sheets for boilers to prevent rusting, and why is it not done, especially in small boilers that are only used occasionally? A. Small house boilers are frequently galvanized. It would probably be difficult to do the work thoroughly enough, in the case of stationary and marine boilers, to ensure protection.

In looking over some back volumes of the SCIENTIFIC AMERICAN, I find (on p. 110, vol. 6) an answer to F. N. B. Is the 250 lbs. correct? A. Yes.

**G. T. P. says:** How do you find the length of the chord of an arc when the radius and the length of the arc are given, being 15 and 11·781 inches respectively? A. First find the circumference of the circle. It will be radius $\times 2 \times 3{\cdot}1416 = 94{\cdot}2478$ inches. Then the angle at the center of the circle, subtended by the given arc, will be $\frac{11{\cdot}781}{94{\cdot}2478} \times 360° = 45° +$ And the required chord will be $\sqrt{2 \times (15)^2 - 2 \times (15)^2 \times \text{cosine } 45°} =$ 11·45 inches, nearly. To generalize this method: Let R = radius of circle, a = length of arc, C = length of chord, A = angle at center. $A = \frac{a \times 360°}{2 \times 3{\cdot}1416 \times R}$
$C = \sqrt{2R^2 - 2R^2 \times \cos A}$.

**J. S. asks:** What metals are used to make white metal and what are the proportions of each? A. Tin 21 lbs., copper 0·4 lb., antimony 1·2 lb. 2. What will make a suitable metal for handles and mountings? A. Tin 14 lbs., copper 0·2 lb., antimony 0·5 lb. 3. What are the proportions of type metal? A. Lead 9 lbs., antimony 1 lb.

**H. P. M. says, in reply to H. B., who asks** for a solution to remove the sand or scale from castings: The following will do it and is more simple than the one you gave: One part vitriol to four of water. The castings need only be wetted either by dipping them in or pouring it on. In 12 hours, the scale wi[ll be] thoroughly removed. They should then be w[ashed] clean.

**MINERALS, ETC.**—Specimens have been received from the following correspondents, and examined with the results stated:

A. K.—It is a sample of spiegeleisen. It is a valuable product, produced by smelting, in a blast furnace with charcoal, a spathic iron ore containing a large percentage of manganese.—W. H. R.—Your supposed animated horsehair is a species of the genus *gordius*, frequently found in still water; it is not thicker than a horsehair, and is popularly considered to be a hair of that description in the act of being transformed into an eel. Linnæus calls it *gordius aquaticus*.—J. P.—It is galena, an ore of lead.—A. B. C.—It is a sample of a fine quality of clay. Shale has the property (which clays have) of capability of being kneaded up with water and fashioned like paste by the hand; but it is a much stronger and firmer clay than the sample sent.—A. H.—It is magnetite, inclosing granules of apatite or phosphate of lime. All minerals are reported upon in the week in which they are received, except such few as require a longer period for analysis. The last have not altogether exceeded a dozen in number.

W. J. B. says: I have constructed two large sliding doors 10 feet high, 5 feet wide, and 2½ inches thick. They run on a round track on the bottom, with small pulleys on the top. I have weighted them so that they will open themselves as soon as unlocked, and I want a device that will shut them after they have been open 2 or 3 minutes. Can any of your readers inform me of one?—D. W. asks: 1. How can I make a cheap sealing wax of a violet color? 2. How can I make a good indelible ink, to be used with a stencil plate, for marking clothing?

## COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Popular Fallacies. By A. D. F. H,
On the Cardiff Giant. By E. X.
On the Movements of a Gum Ball. By R. L. S.
On the Philosophy of Thunderstorms. By J. H. G.
On Swimming with the Clothes On. By W. A. H.
On a Remarkable Prescription. By Z.T.D.
On Strained Honey. By H. W. S.
On a Family killed by Lightning. By P.D.R.

## HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Please to inform me where I can buy sheet lead, and the price? Where can I purchase a good brick machine? Whose steam engine and boiler would you recommend? Which churn is considered the best? Who makes the best mucilage? Where can I buy the best style of windmills?" All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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## APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

30,536.—GAS FITTING FINISHING MACHINE.—J. W. Lyon. October 14.

30,937.—OILING SPINDLES.—E. N. Steere. December 2.

## EXTENSIONS GRANTED.

29,374.—THRASHING AND CLEANING MACHINE.—I. Hart.
29,409.—RAILWAY CATTLE CARS.—G. W. Chambers.

## DISCLAIMER.

133,878.—GLOVE.—J. F. Mason.

## DESIGNS PATENTED.

7,589 to 7,595.—CARPETS.—R. Allan, Yonkers, N. Y.
7,596.—PEN RACK.—B. Brower, New York city.
7,597.—INKSTAND BASE.—B. Brower, New York city.
7,598.—BADGE.—R. D. Green, Lowndes county, Miss.
7,599.—URN AND PEDESTAL.—H. E. Wesché, Phila., Pa.
7,600.—GLASS BOTTLES.—C.C.Woodworth, Rochester, N.Y.
7,601.—CHILD'S CARRIAGE.—A. Shoeninger, Chicago, Ill.

## TRADE MARKS REGISTERED.

1,899.—MEDICAL COMPOUND.—E.A. Butts, Wash'ton, D.C.
1,900.—MILK PANS.—C. A. Douglas, Franklin, N. Y.
1,901.—PICKLES, ETC.—Du Vivier & Co., New York city.
1,902.—COFFEE EXTRACT.—G. W. Earhart, Columbus, O.
1,903.—THERMOMETERS, ETC.—J. S. F. Huddleston, Boston, Mass.
1,904.—GIN.—Wellington & Co., New York city.
1,905.—WINE.—Wellington & Co., New York city.
1,906.—MEDICAL COMPOUND.—E. K. Al Burtis, Ridgefield, N. J.
1,907.—SAUCE.—Lea & Perrins, Worcester, England,
1,908.—COTTON GINS.—Sanborn Machine Company, Mystic River, Conn.
1,909 & 1910.—KNIT GOODS.—American Hosiery Company, New Britain, Conn.

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## CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA

JULY 31, 1874.

3,694.—E.M. Davis, Allegheny, Allegheny county, Pa., U. S., and F.J. Rebbeck, Pittsburgh, Allegheny county, Pa., U. S. Improvements on curtain fixtures, called "The Davies & Rebbeck Curtain Fixtures." July 31, 1874.

3,695.—P. Griffin, Cork, Cork county, Ireland. Improvement on the manufacture of spirits, called "Griffin's Purified Spirits." July 31, 1874.

3,696.—D. Forbes, Cambridge, Middlesex county, Mass., U. S., assignee of H. Wells, Woburn, Middlesex county, Mass., U. S. Improvements on needle threading hooks, called "The Magic Needle Threader." July 31, 1874.

3,697.—N. E. Wheeler, London, Ont., assignee of C. D. Blinn, Port Huron, St. Clair county, Mich., U. S. Improvements on window blinds or shades, called "A Lap Window Shade." July 31, 1874.

3,698.—A. Lorrain, Bord-à-Plouffe, Lavalle county, P. Q. Improvement on wheel horse powers, called "Lorrain's Horse Power Wheel." July 31, 1874.

3,699.—F. M. Snively, Bellaire, Belmont county, O., U. S. Improvement on trace fastenings, called "Snively's Improved Trace Fastening." July 31, 1874.

3,700.—H. Ing, Hamilton, Wentwtrth county, Ont. A gas regulator, called "Ing's Improved Gas Regulator." July 31, 1874.

3,701.—C. H. White, White's Station, Calhoun county, Mich., U. S. Improvements on railway switches and frogs, called "White's Safety Railway Switch." July 31, 1874.

3,702.—W. Vahey, Forest Village, Lambton county, Ont. Improvement on machines for blocking horse collars, called "Vahey's Collar Blocking Machine." July 31, 1874.

3,703.—W. Murphy, Petitcodiac, New Brunswick. Improvements on organ blow pedals, called "Murphy's Reversible Organ Blow Pedals." July 31, 1874.

3,704.—G. Webster and J. F. Webster, Hamilton, Wentworth county, Ont. Improvements in sewing machines, called "The Webster Hand Shuttle Machine." July 31, 1874.

3,705.—J. Dwyer and J. V. Carter, Detroit, Wayne county, Mich., U. S. Improvements in base-burning heating stoves, called "The Crown Jewel Stove." July 31, 1874.

3,706.—W. Craig, Nunda, Livingston county, N. Y., U. S., assignee of H. C. Grover, same place. Improvements on washing machines, called "Grover's Improved Washing Machine." July 31, 1874.

3,707.—D. N. B. Coffin, Jr., Newton, Middlesex county, U. S. Improvements on capstans and windlasses, called "Coffin's Capstans and Windlasses." July 31, 1874.

3,708.—L. O. P. Meyer, Newtown, Fairfield, Conn., U. S. A certain india-rubber compound presenting a surface against which what are known as safety matches can be ignited, called "Meyer's Igniting Rubber." July 31, 1874.

3,709.—D. C. Kellam, Pontiac, Oakland county, Mich., U. S., and R. and A. Hayes, Detroit, Wayne county, Mich., U. S. Improvement on window screen frames, called "Kellam's Adjustable Window Screen." July 31, 1874.

3,710.—B. Tappan, Steubenville, Jefferson county, O., U. S. Improvement in miners' lanterns, called "Tappan's Miner's Lantern." July 31, 1874.

3,711.—H. Whiteside, Jr., Ottawa, Carleton county, Ont. Improvements on spring slats for beds, called "Whiteside's Improved Spring Slat." July 31, 1874.

3,712.—H. Behning, New York city, U. S., and J. Diehl, same place. Improvements in pianofortes, called "Behning & Diehl's Improved Agrafle for Pianofortes." July 31, 1874.

3,713.—E. S. Waterman, Hamilton, Wentworth county, Ont. Improvement in bed bottoms, called "Waterman's Superior Strap Steel Spring Bed Bottom." July 31, 1874.

3,714.—W. T. Redding, New York city, U. S. Improvements on metallic or other boxes for blacking or analogous uses, called "The Redding Improved Box." July 31, 1874.

3,715.—W. Morehouse, Buffalo, Erie county, N. Y., U. S. Improvements on ship knees, called "Morehouse's Improved Ship Knee." July 31, 1874.

3,716.—W. B. Hall, Lancaster, Lancaster county, Pa. U. S. Improvements in cartridge-creasing and loading implements for breech-loading firearms, called "W. B. Hall's Cartridge Creaser." July 31, 1874.

3,717.—W. H. Beckett, Chelmsford, Essex county, Eng. Improvements in valve apparatus for controlling the flow or passage of fluids, called "Dennis & Co.'s Patent H. P. Valve." July 31, 1874.

3,718.—W. M. Watson, Tonica, La Salle county, Ill., U.S. Improvements on nut locks, called "Watson's Improved Nut Lock." July 31, 1874.

3,719.—C. Comstock, New Canaan, Fairfield county, Conn., U. S. Combined hot air and hot water furnace, called "Comstock's Ventilating Steam Heater." July 31, 1874.

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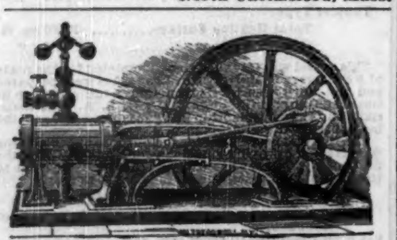

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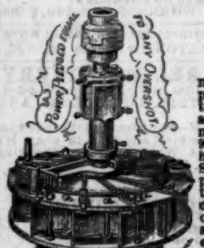


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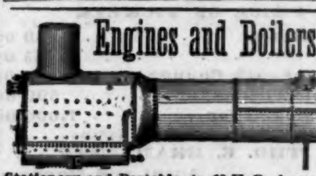

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